### An Ecological Survey of Factors Affecting

# Fish Production in a Louisiana Natural Lake and River

BY KENNETH E. LANTZ

LOUISIANA WILD LIFE
AND
FISHERIES COMMISSION
P. O. BOX 44095, CAPITOL STATION
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# An Ecological Survey of Factors Affecting Fish Production in A Louisiana Natural Lake and River

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**A Dingell-Johnson Project**
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# CONTENTS

Abstract ........ 9

Introduction ........ 11

Material and Methods ........ 14

Results and Discussion ........ 17

Fish Distribution, Production and Reproduction in Sabine River ........ 17

Fish Distribution, Production and Reproduction in Lac Des Allemands ........ 32

Physical and Chemical Features of Lac Des Allemands ........ 45

Physical and Chemical Features of Sabine River ...... 56

Net and Nanno Plankton Production in Lac Des Allemands ........ 62

Net and Nanno Plankton Production in Sabine River ........ 74

Bottom Fauna in Lac Des Allemands ........ 81

Bottom Fauna in Sabine River ........ 81

Conclusions ........ 87

Literature Cited ........ 91

# ABSTRACT

This completion report covers the eight jobs of Dingell-Johnson Project F-11-R conducted in the Sabine River and Lac Des Allemands from July 1, 1964 through June 30, 1967. The objectives of this study were: (1) to establish quantitatively what types of aquatic areas are rich, average and poor in the production of fish and fish food organisms, (2) to determine what cycles occur in the kinds and abundance of plankton and bottom fauna and (3) to correlate these cyclic occurrences of fish food organisms with variance in fish production in the study areas.

Four stations in the Sabine River, two above and two below the Toledo Bend Dam Site, were sampled monthly for plankton and water chemistries; quarterly for bottom fauna and annually for fish distribution to determine pre-impoundment conditions of the stream. Three stations in Lac Des Allemands were sampled monthly for water chemistries, plankton and bottom fauna and annually for standing crop values of fish per acre in this coastal lake. Monthly and seasonal comparisons between standing crop values and distribution of fish are compared to monthly and seasonal production of net and nanno plankton, bottom fauna and physio-chemical conditions of the two study areas.

Water quality of the Sabine River was similar to that reported by earlier investigators. The water in Toledo Bend Reservoir should be of good quality if oil field brine releases in the drainage are not allowed to increase or are reduced through the use of injection wells.

Lac Des Allemands was a freshwater lake during the winter of each year, but a brackish condition developed in late spring and persisted throughout each summer and fall. The development of the brackish condition coincided with a persistent blue-green algae bloom that prevailed from April through October of each year. The brackish condition probably influenced the movement of game and commercial fish between the lake and adjacent waters.

Plankton production in the Sabine River began to increase

by February of each year, but counts and weights of net and nanno plankton revealed sporadic high to low values from month to month without predictable trends toward summer maximum productivity. The lack of an extended period of high plankton density was associated with peak stream discharges.

The two upper stations of the Sabine River exhibited higher seasonal numbers, volumes and weights of bottom organisms than found at the two lower stations. Maximum production of bottom fauna occurred each spring in the river.

The two major benthic groups in Lac Des Allemands were Tubificidae and Chironomidae, with Chironomidae species being most abundant during peak occurrences of bottom fauna. A seasonal peak occurrence of larval Chironomidae occurred each summer, followed by an early fall buildup of the same group. Stomach samples of channel catfish in the summer and winter indicated a good utilization of Chironomidae larvae.

Annual standing crop values of fish in Lac Des Allemands revealed a high poundage of channel catfish (three year mean of 87 pounds per acre), yet only 20 percent of this weight was of marketable size based on the present Louisiana limit of 13 inches total length. Consideration should be given to reducing the legal marketable size of channel catfish to 10 inches total length in Lac Des Allemands and similar coastal lakes of Louisiana.

Collections of fish in the Sabine River indicate species of Centrarchidae and Cyprinidae were common in this drainage, with no major changes in fish populations from that reported by earlier investigators. Data collected during the fish survey was used in recommending stocking only one native fish species following closure of the Sabine River to create Toledo Bend Reservoir. Largemouth bass fingerlings were stocked in the river in the spring of 1967 and non-native striped bass and walleye fingerlings were stocked in the springs of 1967 and 1968.

# An Ecological Survey of Factors Affecting Fish Production in A Louisiana Natural Lake and River[1]

KENNETH E. LANTZ[2]

## INTRODUCTION

This study was initiated in July, 1964 as an ecological survey of physical, chemical, and biological factors affecting fish production in a lake and river habitat of Louisiana. It included a two and one-half year evaluation of physical and chemical characteristics, plankton, benthos and fish populations in Lac Des Allemands and the Sabine River (Figure 1).

Lac Des Allemands is located in southeast Louisiana in St. John the Baptist, Lafourche and St. Charles Parishes. This natural lake is approximately twenty-four square miles in area and has an ill-defined shoreline of thirty miles of fertile swamp and marshland. This shallow, wind swept area has an average depth of seven feet. It is virtually a fresh-water lake, except during unusually high tides associated with periods of southerly winds that occur in late summer. Tidal water movements from the Gulf also accompany storms and hurricanes moving inland through Barataria Bay, Little Lake and Lake Salvador. The principal tributaries of Lac Des Allemands are Bayou Boeuf, Bayou Chevreuil and Bayou Fortier. Numerous drainage and oil company canals transverse the bordering marsh and swamp areas, resulting in water runoff from these areas into the lake.

Commercial fish harvest has been drastically reduced in most inland areas of Louisiana in recent years, but Lac Des Allemands has continued to produce high yields of catfish. A survey of commercial docks in this drainage area in 1964 (Schafer, 1965) indicated wholesale fish buyers bought more than 2,500,000 pounds of catfish during a twelve month period. This represents a minimum poundage of fish bought as com-

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[1] Contribution from Dingell-Johnson Project F-11-R, Louisiana.

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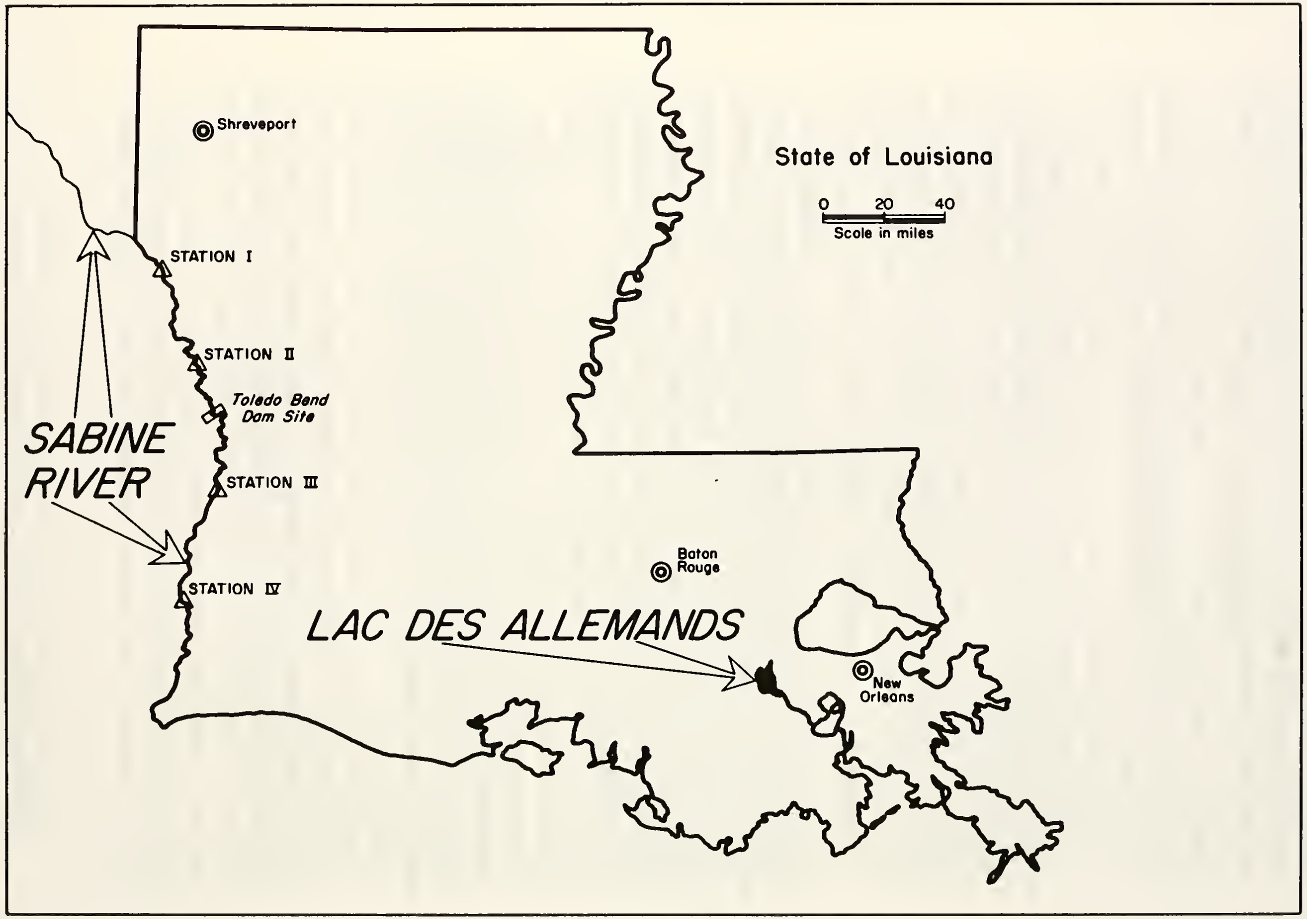

Figure 1—Map of Louisiana Showing Location of Sabine River and Lac Des Allemands

plete records were not available from all buyers. Schafer also found that over fifty families were able to make a living by full time commercial fishing in the lake and associated drainage. The good harvest of catfish species from this lake is remarkable, considering the fact that the only legal methods for commercial fishing in Lac Des Allemands are the use of trotlines with hooks two feet apart and cans placed on the lake bottom (Schafer et al; 1965). Sport fishing by rod and reel for channel, blue and flathead catfish species is a common occurrence in this lake during late spring and early summer. Lac Des Allemands was included in this study to determine what limnological factors contribute to the fish production in this natural lake.

The Sabine River forms a natural boundary between Texas and Louisiana from a point near Logansport southward to its confluence with the Gulf of Mexico at Sabine Pass (Figure 1). The Sabine River basin is about 300 miles long, averages 30 miles wide, and is about 45 miles across at the widest point (Hughes and Leifeste, 1965). The river has many tributaries from its origin in northeast Texas near Greenville southward to the Gulf. Lake Fork Creek in Texas and Bayou Anacoco in Louisiana drain 685 and 431 square miles, respectively. None of the other tributaries drain more than 400 square miles and most of these streams are less than 30 miles long and drain less than 200 square miles. Stream bed gradients of the tributaries are very low and most of the length of the Sabine River has a slope of less than 0.8 foot per mile. The river meanders through heavily forested areas of loblolly, short leaf and long leaf pines in eastern Texas and western Louisiana.

Until recent years, water development projects in the Sabine Basin were comparatively small in size (less than 50,000 acre feet) and built by cities and private business to provide water supplies for municipal and industrial use. Hughes and Leifeste (1965) list the reservoirs in the Sabine River Basin completed or under construction as of January, 1963. In May, 1964 construction was begun on Toledo Bend Reservoir. This 186,000 surface acres impoundment is a joint effort of Texas and Louisiana to supply water and hydroelectric power for both states. Location of Toledo Bend Dam as shown in Figure 1 is approximately eighteen miles west of Leesville, Louisiana. Partial closure of the Sabine River at the dam site was begun in October, 1966 and filling of the lake to normal pool elevation (172.0 MSL) was completed in May, 1968. Selection of sampling stations (Figure 1) for this study were made upstream and downstream from the dam to assist in fish stocking recommendations and evaluating changes in the lake and watershed as the impoundment ages.

## MATERIALS AND METHODS

### *Fish Standing Crop, Distribution and Reproduction Samples*

Annual standing crop samples of fish were collected in Lac Des Allemands by enclosing a one-acre area of water with a one-inch mesh webbing and pumping 1.5 ppm of five percent emulsified rotenone below the water surface (Lambou, 1959). All fish which surfaced were collected, measured and weighed. The webbing was removed from the area following collection of fish which surfaced the first day. Damage to the block-off net by scavenging blue crabs precluded leaving the webbing out until the second day. Three one-acre samples were collected annually in Lac Des Allemands and results averaged to give a mean annual standing crop of fish per acre of water.

Hoop nets, wire traps, common sense seines and an electric fish shocker were used in collection of fish in the Sabine River. Attempts to make rotenone samples in the river proved futile due to velocity and volume of water passing down the basin and public resentment to the loss of fish during this type of sampling. Hoop nets were of the standard seven hoop, two throat type with square mesh size from one to two and one-half inches. The single throat wire traps were three feet long, eighteen inches in diameter, and covered with one-half inch hardware cloth and one by two inch weld wire. The one-half inch mesh traps had a three inch aperature at the throat and the one by two inch mesh traps had a five inch throat opening. The common sense seine was 16 feet long, six feet deep and constructed of three-sixteenth inch Delta nylon netting. The seine was used primarily for collecting minnows, darters and madtoms. The electric fish shocker was a boat-mounted boom type, with electric current supplied by a 110 volt gasoline generator. Collection of fish in the Sabine River was conducted by Dudley C. Carver of the Louisiana Wild Life and Fisheries Commission in conjunction with another study (Carver, 1967).

Six areas of 600-square feet were seined each year in the Sabine River to determine the abundance of young fish of the year. A 30 foot nylon bobbinet minnow seine six feet deep was utilized in these reproduction samples. A lack of suitable seining areas in Lac Des Allemands prevented use of this type of sampling gear. Data collected in annual rotenone samples were utilized to evaluate spawning success in the lake habitat.

### *Physical and Chemical Analyses*

Water samples for monthly field analyses were collected from both areas with an APHA sewage sampler from a depth of three feet. Field determinations included free carbon dioxide, dissolved oxygen using the unmodified Winkler method, and carbonate-bicarbonate alkalinity. Methods used are described by Welch (1948). A Hellige pH color comparator was used for hydrogen ion concentration and water temperatures were measured using a standard mercury thermometer.

Samples collected monthly for laboratory analyses were taken from a depth of three feet with a portable water pump. These samples were frozen and returned to the laboratory for colorimetric determinations of total and available phosphates, organic nitrogen, ammonia nitrogen, nitrate nitrogen and nitrite nitrogen. A Bauch and Lomb Spectronic 20 Colorimeter was used in these determinations. Chlorides were determined with silver nitrate according to Standard Methods (1955).

### *Plankton Samples*

Monthly at each station two 20 liter net plankton samples were taken with a number 25 bolting cloth Wisconsin style plankton net. One 20 liter sample was centrifuged and net plankton counts were conducted using a Sedgwick-Rafter counting cell and a Whipple ocular micrometer (Welch, 1948). The other 20 liter net sample was concentrated by centrifuge for gravimetric analysis. A one liter nanno plankton sample was collected monthly and concentrated for weighing. Gravimetric analyses for net and nanno plankton were conducted by

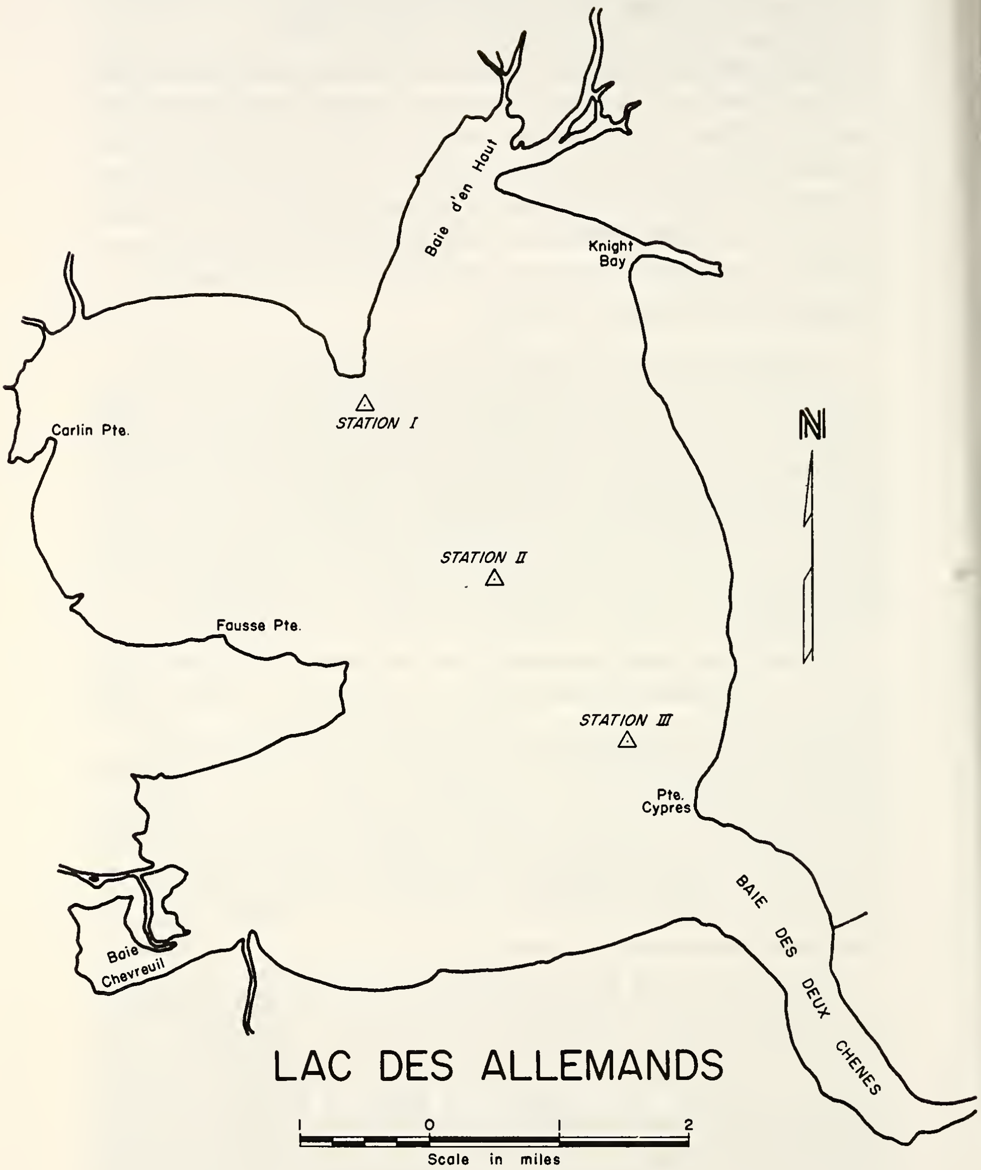

Figure 2—Sampling Stations in Lac Des Allemands

dehydrating the samples at 55°C for 25 hours. The dehyrated weight was recorded and the samples were then incinerated in a furnace at 600°C for 30 minutes. After cooling in a desiccator, the sample was re-weighed. The difference recorded was listed as plankton organic material.

Plankton pigment analyses methods are described by Richards and Thompson (1952) with results listed as mg/liter.

### *Bottom Fauna Collection*

Benthos samples were collected monthly at Lac Des Allemands and quarterly from the Sabine River utilizing a Peterson dredge. Three samples were taken from each station in Lac Des Allemands and pooled for mean monthly station values. One bank and one channel sample was taken from each Sabine River station and pooled for mean values per quarter. Each sample was placed in a tub for washing and then passed through a number 30 mesh seine. All material which remained after mild washing was preserved in 10 percent formalin and returned to the laboratory for analysis.

Hand picking was utilized to remove organisms from the detritus. Organisms were identified, counted, weighed, volumes recorded and the results converted to units per square foot.

Monthly collecting stations for benthos, plankton and physio-chemical samples from both study areas are indicated in Figures 1 and 2.

## RESULTS AND DISCUSSION

### *Fish Distribution, Production and Reproduction in Sabine River*

Limited information is available in the literature concerning the fish populations of the Sabine River. Kemp (1954) conducted a basic survey of the fish along that portion of the Sabine River within and along the boundaries of Gregg County, Texas. A seine was used for collecting, and fish caught were mostly members of the Centrarchidae and Cyprinidae families. Gray (1956) conducted a survey of the fish of Sabine River and its watershed from and including Sabine County to its mouth.

Gray made 62 seining collections on the Texas tributaries of the river and 120 collections from the river proper. Limited notes were given on the abundance of species collected. Cyprinidae, Centrarchidae and Percidae were the families represented by the greatest number of species. He reported centrarchids were well represented in both the river and tributary streams. He stated that at a glance, collection results of Ictaluridae indicated this group as scarce. However, he further states he was unable to time collection trips to coincide with best conditions for collecting members of this family.

TABLE I
LOCATIONS OF SAMPLING STATIONS ON SABINE RIVER
March-September, 1966

| *Station* | *Map Coordinates* | *General Locations* |
|---|---|---|
| S-1B | 31° 11′1″ N, 93° 33′10″ W | Mouth of Bayou Toro |
| S-2B | 31° 9′42″ N, 93° 32′16″ W | ½ mile south of Packer Swamp |
| S-3B | 31° 7′24″ N, 93° 32′16″ W | 1 mile south of Sandy Creek |
| S-1A | 31° 10′10″ N, 93° 35′30″ W | 2 miles north of Toledo Bend Dam |
| S-2A | 31° 12′3″ N, 93° 36′6″ W | Anthony's Ferry |
| S-3A | 31° 15′47″ N, 93° 37′2″ W | Mouth of Blackland Slough |
| S-4A | 31° 16′56″ N, 93° 38′37″ W | 1½ miles north of Blackland Slough |
| S-5A | 31° 26′53″ N, 93° 42′28″ W | 3½ miles south of Pendleton Bridge |
| S-6A | 31° 28′47″ N, 93° 44′26″ W | 1½ miles north of Pendleton Bridge |
| S-7A | 31° 34′18″ N, 93° 49′10″ W | ¼ mile northwest of Brushy Lake |
| S-8A | 31° 43′14″ N, 93° 48′49″ W | ½ mile south of mouth of Siep Branch |
| S-9A | 31° 45′00″ N, 93° 50′18″ W | 1 mile southwest of Boggy Lakes |
| S-10A | 31° 54′33″ N, 93° 55′35″ W | ½ mile east of Ashton Lake |
| S-11A | 31° 55′41″ N, 93° 58′44″ W | ½ mile south of mouth of Castor Bayou |
| S-12A | 31° 59′18″ N, 94° 1′4″ W | 1½ miles north of Logansport Bridge |

Dorchester (1960) conducted a resurvey of the fish of Sabine River. During the resurvey, collections were made at bridge crossings above Longview, Texas while collections below

Longview to Orange, Texas were conducted traveling by boat. A seine was used for collecting the fish. He concluded that no major changes in the fish population occurred during the years between his and Gray's studies. Lantz (1962) conducted a limnological study of four tributaries of Sabine River in Sabine Parish, Louisiana. In conjunction with the limnological investigation, fish occurring in the tributaries were collected. Species of the Cyprinidae and Centrarchidae were very abundant. McDaniel (1968) made a resurvey of the streams studied by Lantz and found similar high populations of cyprinid and centrarchid fishes.

The results of seine, hoop net, wire trap, and electro-fishing gear samples of Sabine River fish taken during this study are presented in Tables II-V. Common and scientific names follow the nomenclature set forth by the American Fisheries Society (1960). The hoop net and wire trap data (Tables II and III) are presented using a twenty-four hour period as one net day. The common sense seine and electro-gear data (Tables IV and V) presents only species of fish and number collected as a quantitative method was not used for collecting the data.

Collections of fish from the Sabine River during this study represented seventeen families, thirty-five genera and sixty-five species. The following is a brief discussion of the families and certain species as reported by Carver (1967):

> *Petromyzontidae*—The chestnut lamprey was always attached to another fish, mainly smallmouth buffalo, which were caught in hoop nets. The fish were never taken in great numbers.
>
> *Lepisosteidae*—Alligator gar were observed at station S-8A (Table I) during electric shocking operations, but not collected. Gar were not taken in any of the fishing gear, but if trammel or gill nets had been used, gar could have probably been collected. Gray (1956) collected all four species of gar and stated they were widespread in the drainage, but not abundant.
>
> *Amiidae*—One bowfin was collected in Blue Lake with an electric shocker. Gray (1956) did not find this fish in quantity in the river or tributaries, but stated they are

### TABLE II

### NUMBER OF FISH CAUGHT PER NET DAY IN HOOP NETS

Sabine River, March-September, 1966

| *Species* | *S-1B 25 Net Days* | *S-2B 22 Net Days* | *S-3B 16 Net Days* | *S-1A 20 Net Days* | *S-2A 8 Net Days* | *S-3A 8 Net Days* | *S-4A 8 Net Days* | *S-5A 14 Net Days* | *S-6A 12 Net Days* | *S-7A 12 Net Days* |
|---|---|---|---|---|---|---|---|---|---|---|
| *PREDATORY GAME FISH* | | | | | | | | | | |
| Largemouth bass | ... | 0.05 | 0.13 | ... | ... | ... | ... | ... | ... | ... |
| White crappie | ... | 0.23 | 0.06 | ... | 0.13 | 0.50 | 0.13 | ... | ... | 0.08 |
| Black crappie | 0.12 | 0.14 | 0.13 | ... | 2.50 | 0.25 | ... | ... | ... | 0.08 |
| Total | 0.12 | 0.42 | 0.32 | ... | 2.63 | 0.75 | 0.13 | ... | ... | 0.16 |
| *NON-PREDATORY GAME FISH* | | | | | | | | | | |
| Bluegill sunfish | ... | ... | 0.06 | ... | ... | ... | 0.13 | ... | ... | ... |
| Longear sunfish | ... | 0.09 | ... | ... | ... | ... | ... | ... | ... | ... |
| Redear sunfish | ... | ... | ... | ... | ... | 0.13 | ... | ... | ... | ... |
| Warmouth | ... | ... | ... | ... | ... | ... | ... | ... | 0.08 | ... |
| Total | ... | 0.09 | 0.06 | ... | ... | 0.13 | 0.13 | ... | 0.08 | ... |
| *NON-PREDATORY FOOD FISH* | | | | | | | | | | |
| Smallmouth buffalo | 0.32 | 0.05 | 0.13 | 0.05 | 0.88 | 0.75 | 4.50 | 0.50 | 0.17 | 0.17 |
| Carp | 0.12 | 0.64 | 0.13 | 0.15 | ... | ... | ... | ... | ... | 0.08 |
| River carpsucker | 0.20 | 0.05 | ... | 0.05 | 0.25 | 0.25 | 0.38 | 0.07 | 0.08 | ... |
| Spotted sucker | 0.04 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Blue sucker | ... | ... | ... | ... | ... | ... | ... | ... | 0.50 | ... |
| Striped mullet | ... | 0.05 | ... | ... | 0.13 | ... | ... | ... | ... | ... |
| Total | 0.68 | 0.79 | 0.26 | 0.25 | 1.26 | 1.00 | 4.88 | 0.57 | 0.75 | 0.25 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *PREDATORY FOOD FISH* | | | | | | | | | | |
| Channel catfish | 0.32 | 0.18 | ... | ... | ... | 0.63 | ... | ... | 0.42 | 0.08 |
| Flathead catfish | ... | 0.14 | 0.06 | ... | 0.13 | ... | ... | 0.14 | ... | 0.08 |
| Total | 0.32 | 0.32 | 0.06 | ... | 0.13 | 0.63 | ... | 0.14 | 0.42 | 0.16 |
| *FORAGE FISH* | | | | | | | | | | |
| Gizzard Shad | ... | 0.05 | ... | ... | ... | ... | ... | ... | ... | ... |
| Chestnut lamprey* | ... | 0.05 | ... | ... | ... | ... | ... | 0.21 | ... | ... |
| Total | ... | 0.10 | ... | ... | ... | ... | ... | 0.21 | ... | ... |
| GRAND TOTAL | 1.12 | 1.72 | 0.70 | 0.25 | 4.02 | 2.51 | 5.14 | 0.92 | 1.25 | 0.57 |

*Chestnut lampreys attached to smallmouth buffalo

### Table III
### NUMBER OF FISH CAUGHT IN WIRE TRAPS PER TRAP DAY SABINE RIVER, MARCH-SEPTEMBER, 1966

| *Species* | *S-1B 8 Trap Days* | *S-2B 8 Trap Days* | *S-3B 8 Trap Days* | *S-1A 8 Trap Days* | *S-2A 8 Trap Days* | *S-3A 4 Trap Days* | *S-4A 4 Trap Days* | *S-5A 4 Trap Days* | *S-6A 4 Trap Days* | *S-7A 6 Trap Days* | *S-11A 14 Trap Days* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *PREDATORY GAME FISH* | | | | | | | | | | | |
| Spotted bass | ... | ... | ... | ... | ... | ... | ... | ... | ... | 0.33 | ... |
| White crappie | ... | ... | ... | 0.25 | 0.25 | ... | ... | ... | ... | ... | ... |
| Black crappie | ... | ... | 0.13 | 0.13 | ... | 0.25 | ... | ... | 0.25 | ... | 0.14 |
| Total | ... | ... | 0.13 | 0.38 | 0.25 | 0.25 | ... | ... | 0.25 | 0.33 | 0.14 |
| *NON-PREDATORY GAME FISH* | | | | | | | | | | | |
| Bluegill | ... | ... | 0.25 | ... | 0.25 | ... | ... | 0.50 | 0.50 | ... | 0.57 |
| Longear sunfish | 2.59 | 0.50 | 2.25 | 0.13 | 1.75 | 1.25 | 2.25 | 2.50 | 1.00 | 0.50 | 0.57 |
| Orangespotted sunfish | 0.38 | 0.50 | 0.88 | 0.13 | 0.25 | ... | 0.25 | ... | ... | ... | ... |
| Redear sunfish | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 0.07 |
| Spotted sunfish | ... | ... | 0.13 | ... | ... | ... | ... | ... | ... | ... | ... |
| Warmouth | ... | ... | ... | ... | ... | ... | ... | 0.25 | ... | ... | 0.07 |
| Total | 2.97 | 1.00 | 3.51 | 0.26 | 2.25 | 1.25 | 2.50 | 3.25 | 1.50 | 0.50 | 1.28 |
| *NON-PREDATORY FOOD FISH* | | | | | | | | | | | |
| Carp | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 0.14 |
| Freshwater drum | ... | ... | ... | ... | ... | ... | ... | ... | ... | 0.16 | ... |
| Smallmouth buffalo | ... | ... | ... | ... | ... | ... | 0.75 | ... | ... | ... | ... |
| River carpsucker | 0.13 | 0.25 | ... | 0.38 | ... | ... | ... | 0.50 | ... | 0.16 | 0.07 |
| Total | 0.13 | 0.25 | ... | 0.38 | ... | ... | 0.75 | 0.50 | ... | 0.32 | 0.21 |

|  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *PREDATORY FOOD FISH* |  |  |  |  |  |  |  |  |  |  |  |
| Channel catfish | 0.13 | 1.75 | 0.63 | 0.13 | 0.25 | 0.25 | ... | ... | ... | 0.50 | ... |
| Flathead catfish | ... | 0.13 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Blue catfish | ... | 0.25 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Yellow bullhead | ... | ... | ... | ... | ... | 0.50 | ... | ... | ... | ... | ... |
| Spotted gar | 0.13 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Total | 0.26 | 2.13 | 0.63 | 0.13 | 0.25 | 0.75 | ... | ... | ... | 0.50 | ... |
| *FORAGE FISH* |  |  |  |  |  |  |  |  |  |  |  |
| Chestnut lamprey | ... | ... | ... | ... | 0.25 | ... | ... | ... | ... | ... | ... |
| Spottail shiner | ... | ... | 0.50 | ... | ... | ... | ... | ... | 0.25 | ... | ... |
| Bullhead minnow | ... | 0.13 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Total | ... | 0.13 | 0.50 | ... | 0.25 | ... | ... | ... | 0.25 | ... | ... |
| GRAND TOTAL | 3.36 | 3.51 | 4.77 | 1.15 | 3.00 | 2.25 | 3.25 | 3.75 | 2.00 | 1.65 | 1.63 |

## Table IV
## FISH COLLECTED IN COMMON SENSE SEINE
## SABINE RIVER MARCH-SEPTEMBER, 1966

*Number Collected at Each Station*

| *Species* | S-1B | S-2B | S-3B | S-1A | S-5A | S-6A | S-7A | S-8A | S-9A | S-10A | S-12A | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atlantic needlefish | ... | ... | ... | ... | ... | ... | ... | 1 | ... | ... | ... | 1 |
| Spotted gar | ... | ... | ... | ... | 1 | ... | ... | ... | ... | ... | ... | 1 |
| Longnose gar | ... | ... | ... | ... | 1 | ... | ... | ... | ... | ... | ... | 1 |
| Freshwater drum | ... | ... | ... | ... | 9 | ... | 9 | ... | 2 | 1 | ... | 21 |
| Striped mullet | ... | ... | ... | ... | ... | ... | ... | ... | 2 | ... | ... | 2 |
| Gizzard shad | ... | ... | ... | 1 | 2 | 9 | ... | ... | ... | 2 | 2 | 16 |
| Threadfin shad | ... | ... | 2 | ... | 5 | ... | ... | ... | 4 | 7 | ... | 18 |
| Brook silverside | ... | ... | ... | 6 | ... | 2 | ... | ... | ... | ... | ... | 8 |
| *Hybognathus sp.* | 939 | 211 | 636 | 269 | 367 | 249 | 100 | ... | 50 | 1203 | 96 | 4120 |
| Speckled chub | 5 | ... | ... | ... | ... | 4 | 1 | ... | 1 | ... | ... | 11 |
| Golden shiner | 2 | ... | ... | ... | 2 | ... | ... | ... | ... | ... | ... | 4 |
| Pallid shiner | ... | ... | ... | ... | 29 | 52 | ... | ... | ... | ... | ... | 81 |
| Emerald shiner | 66 | 14 | 376 | 75 | 302 | 140 | 100 | ... | 50 | 63 | 549 | 1735 |
| Ghost shiner | ... | ... | 152 | 31 | 44 | 1 | ... | ... | ... | ... | 1 | 229 |
| Ribbon shiner | ... | ... | ... | ... | ... | ... | 9 | ... | ... | ... | ... | 9 |
| Red shiner | 162 | 164 | 1724 | 99 | 393 | 68 | 100 | ... | ... | 1239 | 115 | 4064 |
| Sabine shiner | 69 | 50 | 84 | 20 | 220 | 23 | 39 | ... | 33 | 76 | 11 | 625 |
| Weed shiner | ... | ... | 1 | 6 | 6 | 1 | 21 | ... | 21 | ... | 1 | 57 |
| Redfin shiner | 37 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 37 |
| Blacktail shiner | 23 | 17 | 7 | 17 | 46 | ... | 47 | ... | ... | 59 | 36 | 252 |
| Mimic shiner | ... | 2 | ... | ... | 1 | ... | 15 | ... | 28 | ... | 1 | 47 |
| Pugnose minnow | 2 | ... | 1 | ... | 2 | ... | 6 | ... | ... | ... | ... | 11 |
| Suckermouth minnow | ... | ... | 43 | ... | 11 | ... | 9 | ... | 13 | 29 | ... | 105 |
| Bullhead minnow | 10 | 1 | 125 | 23 | 54 | 52 | 31 | ... | ... | 17 | 15 | 328 |
| River carpsucker | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 | 1 |
| Blue sucker | ... | ... | 2 | ... | ... | ... | ... | ... | ... | ... | ... | 2 |
| Smallmouth buffalo | ... | ... | 1 | ... | 6 | 1 | ... | ... | ... | ... | ... | 8 |
| Spotted sucker | ... | ... | ... | ... | 4 | ... | ... | ... | ... | 1 | 5 | 10 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Yellow bullhead | 1 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 |
| Channel catfish | ... | ... | ... | ... | 2 | ... | ... | ... | ... | ... | 1 | 3 |
| Freckled madtom | 4 | ... | 1 | ... | 4 | ... | 23 | ... | 15 | ... | 21 | 68 |
| Flathead catfish | ... | ... | ... | ... | ... | ... | 1 | ... | 1 | 1 | 2 | 3 |
| Mosquitofish | 19 | 30 | 95 | 28 | 5 | 3 | ... | ... | ... | ... | ... | 180 |
| Golden topminnow | ... | ... | ... | ... | ... | ... | ... | ... | ... | 2 | 3 | 5 |
| Blackstripe topminnow | 10 | 7 | 3 | 6 | 1 | 8 | ... | ... | ... | 97 | 72 | 204 |
| Blackspotted topminnow | 7 | 8 | 11 | 7 | 7 | 4 | ... | ... | ... | ... | ... | 44 |
| Yellow bass | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 | 1 |
| Bluegill | 6 | 1 | 1 | ... | 4 | ... | 1 | ... | ... | 3 | 7 | 23 |
| Longear sunfish | 5 | 2 | 4 | ... | 13 | 5 | 12 | ... | ... | 3 | 7 | 51 |
| Redear sunfish | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3 | 12 | 15 |
| Spotted sunfish | 2 | ... | 2 | ... | ... | ... | ... | ... | ... | ... | 1 | 5 |
| Spotted bass | 9 | 1 | 12 | 9 | 53 | 29 | ... | ... | ... | ... | 61 | 174 |
| Largemouth bass | 22 | ... | ... | ... | ... | ... | ... | ... | ... | 5 | 17 | 44 |
| White crappie | ... | ... | ... | ... | ... | 2 | ... | ... | ... | ... | ... | 2 |
| Black crappie | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 | 1 |
| Western sand darter | 20 | ... | 30 | ... | ... | ... | ... | ... | ... | ... | ... | 50 |
| Scaly sand darter | 20 | 27 | 16 | 1 | 85 | 13 | 23 | 4 | 19 | 31 | 4 | 243 |
| Eastern redfin darter | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3 | ... | 3 |
| Bluntnose darter | ... | ... | ... | ... | ... | 1 | ... | ... | ... | ... | 1 | 2 |
| Slough darter | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 | ... | 1 |
| Harlequin darter | ... | ... | ... | ... | ... | ... | 11 | ... | ... | 3 | ... | 14 |
| Logperch | ... | ... | ... | ... | 1 | ... | ... | ... | ... | ... | 3 | 4 |
| Dusky darter | ... | ... | ... | ... | 9 | 6 | 13 | ... | 12 | 1 | 93 | 134 |
| River darter | ... | ... | 3 | ... | ... | ... | ... | ... | ... | ... | ... | 3 |

GRAND TOTAL ........ 13,087

## TABLE V
## FISH COLLECTED AT STATIONS SAMPLED WITH ELECTRO-FISHING GEAR, SABINE RIVER
## MARCH-SEPTEMBER, 1966

| *Species* | S-7A | S-8A | S-9A | S-10A | S-12A | Blue Lake | Total |
|---|---|---|---|---|---|---|---|
| Spotted gar | .. | .. | .. | .. | .. | 1 | 1 |
| Longnose gar | .. | 4 | .. | .. | .. | .. | 4 |
| Bowfin | ... | .. | .. | .. | .. | 1 | 1 |
| Gizzard shad | 1 | 4 | 1 | .. | 11 | 4 | 21 |
| Threadfin shad | .. | .. | .. | .. | .. | 5 | 5 |
| Carp | 2 | .. | .. | .. | 3 | 2 | 7 |
| Red shiner | .. | 49 | .. | .. | .. | .. | 49 |
| Sabine shiner | .. | 19 | .. | .. | .. | .. | 19 |
| Blacktail shiner | .. | 4 | .. | .. | 23 | .. | 27 |
| Suckermouth minnow | .. | .. | .. | .. | 57 | .. | 57 |
| Bullhead minnow | .. | 50 | .. | .. | .. | .. | 50 |
| River carpsucker | .. | 2 | .. | .. | 3 | .. | 5 |
| Blue sucker | 57 | 1 | .. | .. | .. | .. | 58 |
| Smallmouth buffalo | .. | .. | .. | .. | 1 | 4 | 5 |
| Spotted sucker | .. | .. | .. | .. | .. | 4 | 4 |
| Blacktail redhorse | 2 | .. | .. | .. | 1 | .. | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Yellow bullhead | .. | .. | .. | .. | .. | 3 | 3 |
| Channel catfish | 15 | 6 | 1 | .. | 5 | .. | 27 |
| Flathead catfish | 7 | 1 | .. | .. | 2 | .. | 10 |
| Yellow bass | .. | .. | .. | .. | 6 | .. | 6 |
| Warmouth | .. | .. | .. | .. | .. | 1 | 1 |
| Green sunfish | .. | 1 | .. | .. | .. | .. | 1 |
| Bluegill | .. | .. | 1 | .. | 9 | 11 | 21 |
| Longear sunfish | .. | 14 | 4 | .. | 13 | 5 | 36 |
| Redear sunfish | .. | .. | 1 | .. | 1 | 1 | 3 |
| Spotted sunfish | .. | 3 | .. | .. | .. | .. | 3 |
| Spotted bass | 28 | 14 | 34 | 89 | 42 | 4 | 211 |
| Largemouth bass | .. | 2 | .. | .. | 27 | 17 | 46 |
| White crappie | .. | .. | 1 | .. | .. | .. | 1 |
| Black crappie | .. | .. | .. | .. | 1 | .. | 1 |
| Dusky darter | .. | .. | .. | .. | .. | 1 | 1 |
| Freshwater drum | .. | .. | .. | .. | 3 | .. | 3 |
| Striped mullet | 6 | .. | 4 | .. | 7 | .. | 17 |
| GRAND TOTAL | | | | | | | 707 |

very common and abundant in some of the lakes in the watershed. Lantz (1962) and McDaniel (1968) found this species in the Sabine Parish, Louisiana tributary streams.

*Clupediae*—Gizzard shad exhibited a wide distribution, but were never collected in large numbers. Threadfin shad were also collected in limited numbers.

*Cyprinidae*—Eighteen species of cyprinds were collected during the study. Sabine River supports an abundant population of these excellent forage fishes. The red shiner, *Notropis lutrensis,* was the most abundant species. This shiner is heavily fished for by bait fishermen using minnow jugs set on the sandbars. Another common cyprinid occurrence were two species of *Hyboguathus,* the cypress minnow (*Hybognathus hayi*) and silvery minnow (*H. nuchalis*). Separation of these two species were not determined for each collection due to their similarity and difficulty of positive identification in the field. Other common cyprinids were the emerald shiner, sabine shiner, bullhead minnow and blacktail shiner. Carp exhibited a wide distribution and were more abundant at certain seasons of the year than the data indicates. Several large catches made by commercial fishermen were observed during the survey. Fishermen complained about having to cease fishing when the carp run occurred in the spring. This fish was practically all they caught and no market exists in the area for this species.

*Catostomidae*—The smallmouth buffalo is an abundant fish in the Sabine River and also has a wide distribution. This species was collected in quantity in April when the river was fluctuating due to spring rains. It is heavily fished by commercial fishermen using hoop nets in the spring. Several fishermen were checked with large catches of smallmouth buffalo. Another common catastomid of the Sabine River was the blue sucker, *Cycleptus elongatus.* It was taken in quantity at station S-7A where a concentrated effort was made to collect this species. The blue sucker was thought to be rare in the State, but recent sampling efforts in the Sabine River and streams of southeastern Louisiana indicates this belief as false (Douglas and Davis, 1967). This species was always collected in or near rapids in the river. Another widely distributed fish was the river carpsucker, but it was never collected in large numbers.

*Ictaluridae*—Channel catfish are abundant in the Sabine River and widely distributed. This fish is sought after by commercial fishermen in the drainage utilizing trotlines. Flathead catfish are also common in the Sabine. Blue catfish were collected at only one station and only two specimens were collected. There appears to be a very low population of this excellent predator in the Sabine River.

*Anquillidae*—American eel were not collected, but observed at Station S-8A and S-9A during electric shocking operations.

*Belonidae*—A single specimen of the Atlantic needlefish, *Strongylura marina,* was collected at Sation S-8A. Another specimen was observed on a trotline at Station S-1B.

*Cyprinodontida*—Blackstripe topminnow, *Fundulus notatus,*and blackspotted topminnow, *F. olivaceus,* are common and widespread. The golden topminnow, *F. chrysotus,* was more scarce and not widely distributed.

*Poeciliidae*—This family was represented only by the mosquitofish, *Gambusia affinis.* Although not collected, this species was observed at all stations.

*Serranidae*—Yellow bass were present, but appeared to be scarce. Limited numbers were collected. Gray (1956) states that this fish in apparently very scarce.

*Centrarchidae*—This family is well represented in the Sabine River with eleven species being collected during the study. Sampling indicated the spotted bass to be the most abundant species of this family. At the majority of the stations sampled, many specimens were collected, especially young fish-of-the-year. Largemouth bass were also common in the river. The second most abundant species in the family was the longear sunfish. This species was collected at all stations. Bluegill were also common in the river and widely distributed. Black and white crappie were found in the river, with the black crappie being the more abundant. Warmouth, green sunfish, redear sunfish, and spotted sunfish were also collected during the survey.

*Percidae* — Eight species of darters were collected during the survey with the scaly sand darter, *Ammocryta vivax,* and dusky darter, *Percina sciera,* being the most abundant. *Ammocryta clara, Etheostoma artesiae, E. chlorosomum, E. gracile, E. histrio, Percina caprodes,* and *P. shumardi* were the other darter species collected in the Sabine River.

*Sciaenidae*— Freshwater drum were never collected in quantity, but appear to be common in that section of the Sabine River north of the Toledo Bend Dam site.

*Mugilidae*— Striped mullet are very common in the Sabine; with observations made at all stations. A large concentration of mullet usually congregate at the waste discharge of a poultry plant at Logansport, Louisiana. Fishermen were occasionally seen snag-fishing for this species. This species was difficult to collect during seining due to its ability to rapidly avoid the seine.

*Atherinidae*— Brook silversides were collected in limited numbers and appears to be scarce in the Sabine River.

Tables VI and VII presents the results of collections of young fish-of-the-year from seine samples in July of 1965 and 1966. These results further emphasize the abundance of redfin shiners, cypress minnow and spotted bass in the Sabine River.

Analysis of data collected during this survey and data of past surveys of Kemp (1954), Gray (1956), Dorchester (1960) and Lantz (1962) indicate a definite structure of fish fauna in the Sabine River. The surveys reveal that the Sabine River supported a high population of forage and rough fish. Louisiana Wild Life and Fisheries Commission and Texas Parks and Wildlife biologists used this data in recommending a stocking of 3,000,000 largemouth bass fingerlings in the Sabine River in the spring of 1967. The foremost reason for stocking largemouth bass was to establish an efficient predator in sufficient quantity to curtail the expected forage and rough fish population buildup in Toledo Bend Reservoir. No other native game fish will be stocked in the reservoir. Bluegill and redear sunfish populations usually expand rapidly in newly created reservoirs. Another reason for not stocking other native game fish was the 188 oxbow lakes, ponds and sloughs that will be inundated when the reservoir reaches power pool stage at 172. 0 MSL. Native stocks of fish in these bodies of water will greatly increase the population potential of these species.

TABLE VI
YOUNG FISH OF THE YEAR FROM
SABINE RIVER IN JULY, 1965[1]

*Mean Number of Fish*

| *Length (Inches)* | *Largemouth Bass* | *Spotted Bass* | *Cypress Minnow* | *Blacktail Shiner* | *Red Shiner* |
|---|---|---|---|---|---|
| 1.0 | | | | | |
| 1.5 | | | | 4.0 | |
| 2.0 | | | 10.3 | | 4.0 |
| 2.5 | | | | | |
| 3.0 | | | | | |
| 3.5 | 0.3 | | | | |
| 4.0 | | 0.7 | | | |
| TOTAL | 1.8 | 4.2 | 61.8 | 24.0 | 24.0 |

[1] Average of six 600 square feet seine samples in July, 1965

TABLE VII
YOUNG FISH OF THE YEAR FROM
SABINE RIVER IN JULY, 1966[1]

*Mean Number of Fish*

| *Length (Inches)* | *Spotted Bass* | *Cypress Minnow* | *Blacktail Shiner* | *Red Shiner* |
|---|---|---|---|---|
| 1.0 | 0.3 | | | |
| 1.5 | | | | |
| 2.0 | 0.5 | 146.3 | 5.5 | 4.8 |
| 2.5 | | | | |
| 3.0 | 0.5 | | | |
| 3.5 | | | | |
| 4.0 | 1.0 | | | |
| TOTAL | 13.8 | 876.8 | 33.0 | 28.8 |

[1] Average of six 600 square feet seine samples in July, 1966

Two non-native predator fish species, striped bass *(Roccus sax-*

*atilis)* and walleye (*Stizostedion vitreum*), were stocked in the Sabine River in the spring of 1967 by Louisiana fisheries personnel. Interest in recent years toward use of striped bass in large impoundments has been heightened by the apparent success of introduction in several Southeastern states. Striped bass utilize open waters of a lake and are capable of controlling shad population through predation on this forage species. Toledo Bend Reservoir will contain large areas of deep open water which will be unsuitable for native game fish, but favorable for striped bass foraging on the expected high gizzard shad population. In the spring of 1967, Louisiana released 48,630 striped bass fingerlings in the partially filled impoundment. In an effort to create a better predator-prey fish relationship and also fill a potential niche in this ecosystem, 73,280 walleye fingerlings were also stocked in 1967. The success of the stocking of both of these non-native fish is uncertain but tentative plans are to continue stocking these fish during the next two years in an effort to establish a fishable population in Toledo Bend Reservoir.

### *Fish Distribution, Production and Reproduction in Lac Des Allemands*

Prior to this study, no data was available in the literature concerning the fisheries of Lac Des Allemands. Posey made three one-acre block off net rotenone samples in 1961 in the Lac Des Allemands-Bayou Des Allemands system (personnel communication). The fish population samples revealed a standing crop of 213.5 pounds of fish per acre. Of this average value 194.5 pounds were catfish. Posey indicated that about 90 percent of the total number of catfish found were channel catfish and most of the fish of this species were under 14 inches total length. Posey further stated that he thought these standing crop values were conservative since no fish were picked up on the second day due to the scavenging action of blue crabs. Table X presents results of Posey's July, 1961 rotenone samples.

Tables VIII and IX present the results of 1965-67 June rotenone samples taken during this study in Lac Des Allemands. These standing crop results are minimal as second day pick up of fish was impossible due to the scavenging action of blue crabs. Standing crop values in pounds of fish per acre were similar in 1965 and 1966, 78.0 and 78.3 pounds respectively, but

## MEAN NUMBER OF FISH PER ACRE FROM THREE ONE-ACRE ROTENONE SAMPLES* TAKEN EACH JUNE IN LAC DES ALLEMANDS

| | *Available Size* | | | *Intermediate Size* | | | *Fingerling Size* | | |
|---|---|---|---|---|---|---|---|---|---|
| *Species* | 1965 | 1966 | 1967 | 1965 | 1966 | 1967 | 1965 | 1966 | 1967 |
| *Predatory Game Fish* | | | | | | | | | |
| Yellow bass | 6.0 | 2.5 | 0.3 | .. | .. | .. | .. | .. | .. |
| White crappie | 0.3 | .. | .. | 1.0 | .. | .. | 6.0 | .. | .. |
| Black crappie | 7.0 | 0.5 | 3.7 | 3.0 | 0 | 7.0 | 3.3 | 148.5 | .. |
| TOTAL | 13.3 | 3.0 | 4.0 | 4.0 | 0.0 | 7.0 | 9.3 | 148.5 | 0.0 |
| *Non-Predatory Game Fish* | | | | | | | | | |
| Bluegill | 5.8 | 2.0 | 0.3 | 9.0 | 4.5 | 2.0 | 4.0 | .. | .. |
| Redear sunfish | 1.0 | 2.0 | 1.0 | .. | .. | 2.3 | .. | .. | .. |
| TOTAL | 6.8 | 4.0 | 1.3 | 9.0 | 4.5 | 4.3 | 4.0 | 0.0 | 0.0 |
| *Non-Predatory Food Fish* | | | | | | | | | |
| Carp | 0.7 | .. | 0.3 | .. | 4.0 | .. | 1.7 | 2.0 | .. |
| American eel | .. | 0.5 | .. | .. | 0.5 | .. | .. | .. | .. |
| Striped mullet | 235.0 | 1.5 | 7.3 | .. | 1.0 | .. | .. | .. | .. |
| TOTAL | 235.7 | 2.0 | 7.6 | 0.0 | 5.5 | 0.0 | 1.7 | 2.0 | 0.0 |
| *Predatory Food Fish* | | | | | | | | | |
| Channel catfish | 55.0 | 116.5 | 227.7 | 156.3 | 87.5 | 511.0 | 70.3 | 19.0 | 107.3 |
| Blue catfish | 0.7 | 0.5 | 2.0 | .... | ... | 22.0 | ... | ... | .... |
| Flathead catfish | 0.7 | .. | 1.7 | 1.7 | ... | 2.7 | ... | 2.5 | .... |
| Bowfin | .. | .. | .. | .. | 0.5 | .. | ... | .. | .... |
| Spotted gar | .. | 0.5 | 0.3 | 0.7 | .. | .. | ... | .. | .... |
| TOTAL | 56.4 | 117.5 | 231.7 | 158.7 | 88.0 | 535.7 | 70.3 | 21.5 | 107.3 |
| *Forage Fish* | | | | | | | | | |
| Gizzard shad | 12.7 | .. | 35.3 | .. | .. | 7.7 | .. | .. | .. |
| Threadfin shad | ... | .. | ... | .. | .. | .. | 6.7 | .. | .. |
| Bay anchovy | ... | .. | ... | .. | .. | .. | 3.7 | 50.5 | 26.7 |
| TOTAL | 12.7 | 0.0 | 35.3 | 0.0 | 0.0 | 7.7 | 10.4 | 50.5 | 26.7 |
| GRAND TOTAL | 324.9 | 126.5 | 279.9 | 171.7 | 98.0 | 554.7 | 95.7 | 222.5 | 134.0 |

*1966 data averaged from two one-acre rotenone samples

TABLE IX
MEAN STANDING CROP IN POUNDS OF FISH PER ACRE FROM THREE ONE-ACRE ROTENONE SAMPLES* TAKEN EACH JUNE IN LAC DES ALLEMANDS

| | *Available Size* | | | *Intermediate Size* | | | *Fingerling Size* | | |
|---|---|---|---|---|---|---|---|---|---|
| *Species* | 1965 | 1966 | 1967 | 1965 | 1966 | 1967 | 1965 | 1966 | 1967 |
| *Predatory Game Fish* | | | | | | | | | |
| Yellow bass | 2.1 | 1.2 | 0.5 | .. | .. | .. | .. | .. | .. |
| White crappie | 0.1 | .. | .. | 0.7 | .. | .. | ** tr | .. | .. |
| Black crappie | 3.3 | 0.1 | 1.2 | 0.1 | .. | 0.6 | tr | 1.2 | .. |
| TOTAL | 5.5 | 1.3 | 1.7 | 0.8 | 0.00 | 0.6 | tr | 1.2 | 0.0 |
| *Non-Predatory Game Fish* | | | | | | | | | |
| Bluegill | 1.0 | 0.3 | tr | 0.2 | 0.1 | 0.1 | 0.1 | .. | .. |
| Redear sunfish | 0.3 | 0.3 | 0.1 | | .. | tr | .. | .. | .. |
| TOTAL | 1.3 | 0.6 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 |
| *Non-Predatory Food Fish* | | | | | | | | | |
| Carp | 4.7 | .. | 1.5 | .. | 1.6 | .. | 0.1 | 0.2 | .. |
| American eel | 13.1 | 0.2 | .. | .. | tr. | .. | .. | .. | .. |
| Striped mullet | 0.7 | 1.2 | 10.5 | .. | 0.4 | .. | .. | .. | .. |
| TOTAL | 18.5 | 1.4 | 12.0 | 0.0 | 2.0 | 0.1 | 0.1 | 0.2 | 0.0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Predatory Food Fish* | | | | | | | | | |
| Channel catfish | 26.3 | 58.2 | 106.4 | 9.9 | 12.0 | 46.0 | 1.1 | 0.1 | 2.4 |
| Blue catfish | 0.9 | 0.5 | 1.8 | . . | . . . | 0.7 | . . | . . | . . |
| Flathead catfish | 0.8 | . . | 1.4 | 0.4 | . . . | 0.5 | . . | tr. | . . |
| Bowfin | . . | . . | . . | . . | 0.1 | . . | . . | . . | . . |
| Spotted gar | . . | 0.3 | 0.2 | 0.4 | . . | . . | . . | . . | . . |
| TOTAL | 28.0 | 59.0 | 109.8 | 10.7 | 12.1 | 47.2 | 1.1 | 0.1 | 2.4 |
| *Forage Fish* | | | | | | | | | |
| Gizzard shad | 11.2 | . . | 37.2 | . . | . . | 0.5 | . . | . . . | . . . |
| Threadfin shad | 0.2 | . . | . . . | . . | . . | . . | . . | . . | . . |
| Bay anchovy | . . | . . | . . . | . . | . . | . . | 0.3 | 0.3 | 0.1 |
| TOTAL | 11.4 | 0.0 | 37.2 | 0.0 | 0.0 | 0.5 | 0.3 | 0.3 | 0.1 |
| GRAND TOTAL | 64.7 | 62.3 | 160.8 | 11.7 | 14.2 | 48.4 | 1.6 | 1.8 | 2.5 |

| | 1965 | 1966 | 1967 | Mean |
|---|---|---|---|---|
| Standing crop/acre | 78.0 | 78.3 | 211.7 | 122.67 |

*1966 data averaged from two one-acre rotenone samples

**Trace = less than 0.05 lbs.

### Table X

### MEAN NUMBER AND WEIGHT OF FISH IN POUNDS PER ACRE FROM LAC DES ALLEMANDS-BAYOU DES ALLEMANDS SYSTEM IN 1961*

| | *Available Size* | | *Intermediate Size* | | *Fingerling Size* | |
|---|---|---|---|---|---|---|
| *Species* | No. | Wt. | No. | Wt. | No. | Wt. |
| *PREDATORY GAME FISH* | | | | | | |
| Black crappie | 1.0 | 0.3 | 22.0 | 0.7 | 3.0 | Tr. |
| TOTAL | 1.0 | 0.3 | 22.0 | 0.7 | 3.0 | Tr. |
| *NON-PREDATORY GAME FISH* | | | | | | |
| Bluegill | 4.0 | 0.6 | 27.0 | 1.5 | .. | .. |
| Redear sunfish | 2.0 | 0.2 | 1.0 | 0.1 | .. | .. |
| TOTAL | 6.0 | 0.8 | 28.0 | 1.6 | 0.0 | 0.0 |
| *NON-PREDATORY FOOD FISH* | | | | | | |
| Carp | .. | .. | 1.0 | 0.2 | .. | .. |
| Striped mullet | 6.3 | 9.9 | .. | .. | .. | .. |
| TOTAL | 6.3 | 9.9 | 1.0 | 0.2 | 0.0 | 0.0 |
| *PREDATORY FOOD FISH* | | | | | | |
| Channel catfish | 5.0 | 0.1 | 243.0 | 104.0 | 39.0 | 38.5 |
| Blue catfish | .. | .. | 2.0 | 1.9 | 7.0 | 16.6 |
| Flathead catfish | .. | .. | .. | .. | 1.0 | 30.6 |
| TOTAL | 5.0 | 0.1 | 245.0 | 105.9 | 47.0 | 85.7 |

| | | | | | | |
|---|---|---|---|---|---|---|
| *FORAGE FISH* | | | | | | |
| Gizzard shad | 36.0 | 0.7 | 3.0 | 0.1 | 9.0 | 7.5 |
| TOTAL | 36.0 | 0.7 | 3.0 | 0.1 | 9.0 | 7.5 |
| GRAND TOTAL | 54.3 | 11.8 | 299.0 | 108.5 | 59.0 | 93.2 |

Standing crop/acre = 213.5 pounds

*Averaged from three one-acre rotenone samples taken by Lloyd Posey, Louisiana Wild Life and Fisheries Commission in July of 1961.

increased to 211.7 pounds in 1967 (Table IX). The mean for the three years was 122.7 pounds. Increased poundage in 1967 was due primarily to channel catfish with some increase also shown in striped mullet and gizzard shad. Numerical increases in these three species also occurred in 1967 (Table VIII).

The increase in pounds of fish per acre from 1965 and 1966 to 1967 may be due in part to sampling error and the schooling of fish. This increase is believed to be primarily due though to an actual increase of fish (particularly channel catfish) in the lake during the 1967 collecting period. This increase is probably due in part to a movement of fish into the lake from adjacent areas. Although this study was not designed to detect movement of fish into or out of the lake from adjacent areas, a movement of catfish species was suspected between Lac Des Allemands through Bayou Des Allemands into Lake Salvador and the Intracoastal Waterway. Commercial fishermen reported a progressive increase in catches in Bayou Des Allemands and Lac Des Allemands as late spring and early summer water conditions changed from fresh to brackish. Fishermen utilizing trotlines and slat traps moved their gear progressively northward from areas of Lake Salvador up Bayou Des Allemands into Lac Des Allemands in pursuit of schooling channel catfish from April through July. The better fishermen had reasonably good knowledge during this period as to the better catch areas, with an obvious northward trend from late spring into early summer.

Perry (1967) found a similar inland movement of channel catfish from the Gulf Coast into Grand Lake, a freshwater lake of southwestern Louisiana. Perry attributed this movement to salinity increases from June through late fall. Chemical data collected during this study in the 1965 and 1966 spring, summer and fall seasons support the idea of brackish conditions developing in Lac Des Allemands during the summer of each year. Total chlorides, pH and carbonate alkalinity values in Lac Des Allemands steadily increased beginning in April and persisting through late fall of each year (Figure 3 through Figure 5).

Numerical and weight values from standing crop samples during this study and samples by Posey in 1961 reveal that Lac Des Allemands supports a heavy commercial fish population

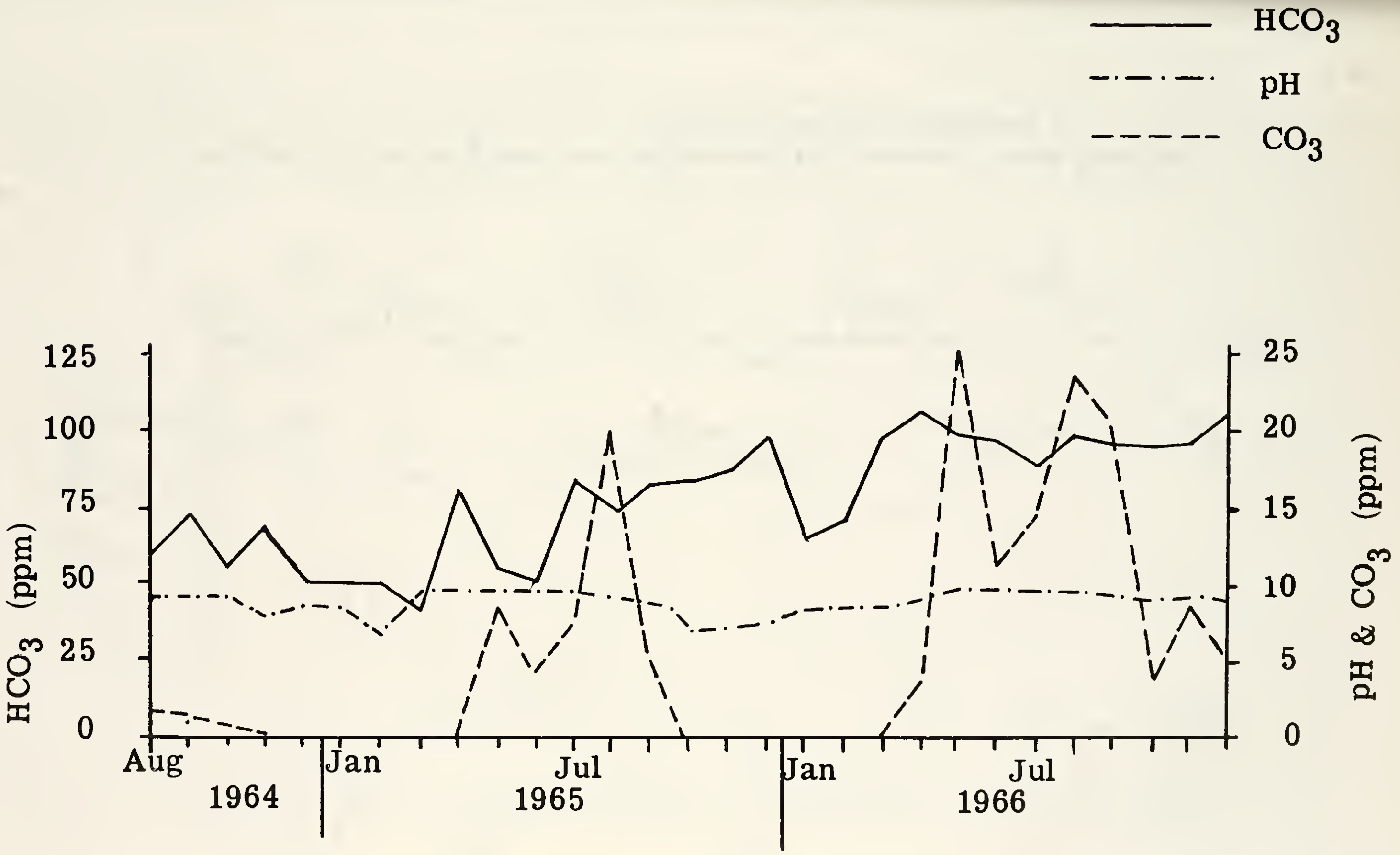

Figure 3—Monthly Variations in Carbonate and Bicarbonate Alkalinities and pH Values in Lac Des Allemands

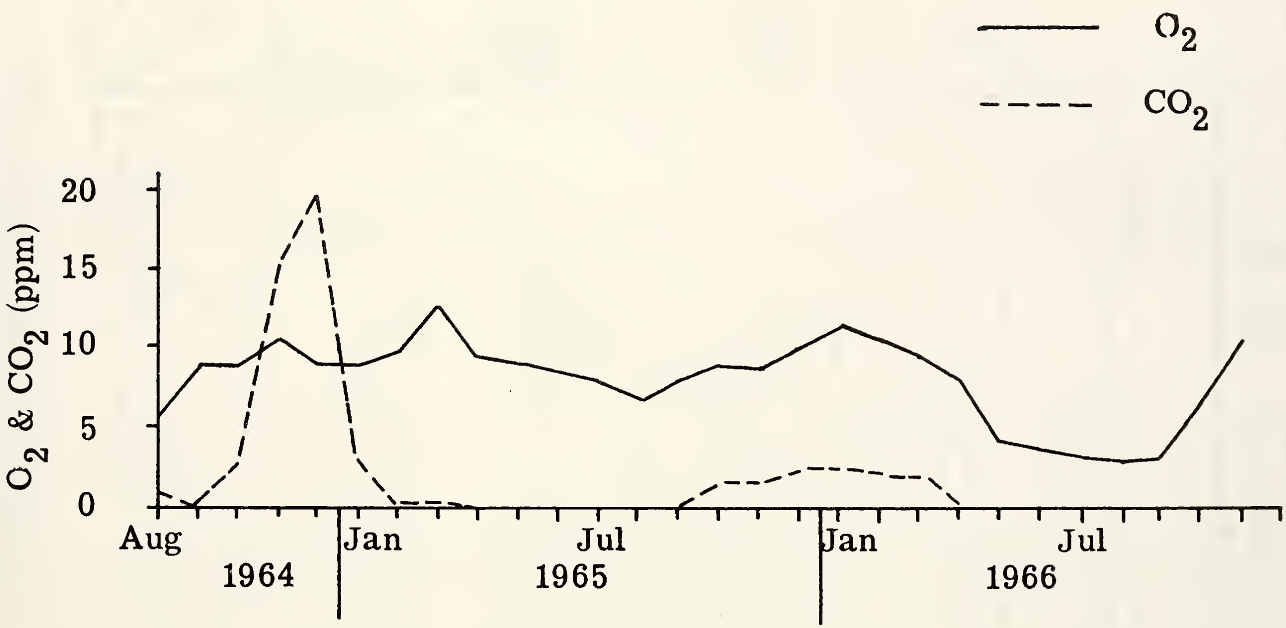

Figure 4—Monthly Variations in Dissolved Oxygen and Carbon Dioxide Values in Lac Des Allemands

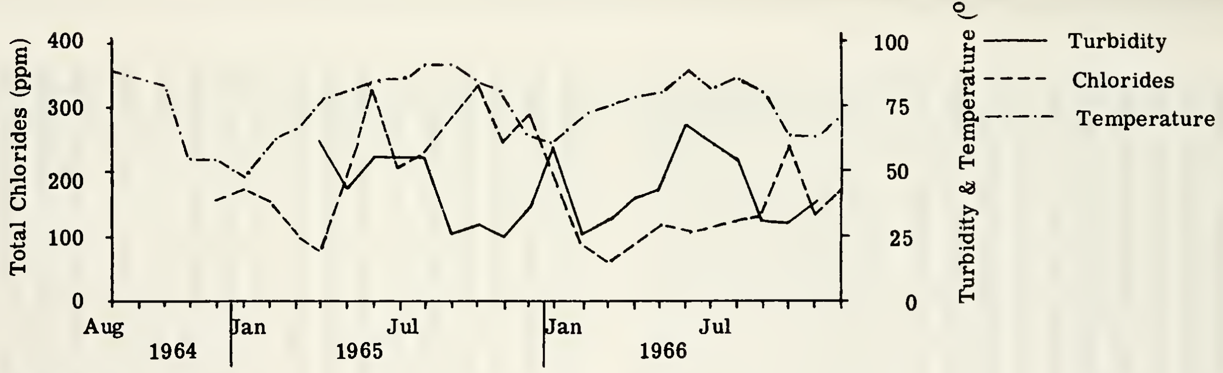

Figure 5—Monthly Variations in Total Chlorides, Turbidity and Temperature Values in Lac Des Allemands

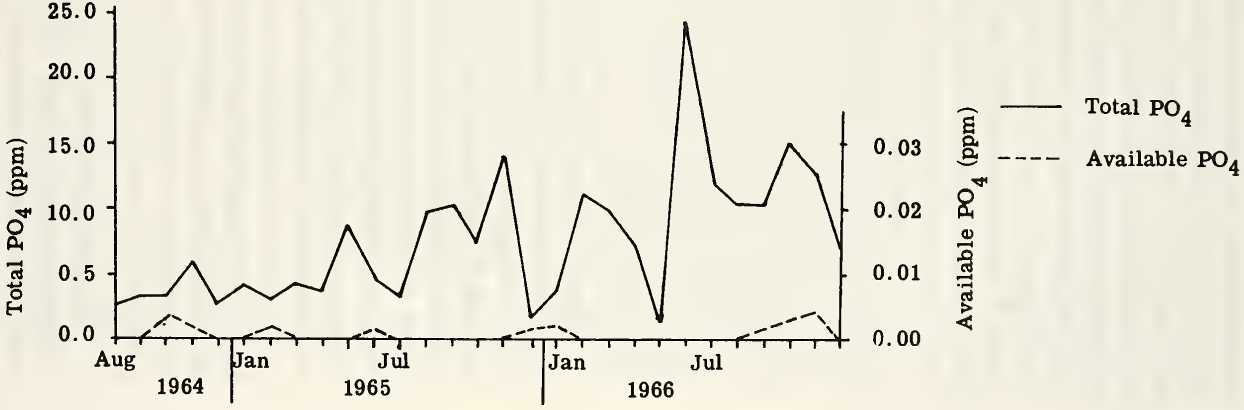

Figure 6—Monthly Variations in Available and Total Phosphate Values in Lac Des Allemands

and a moderate sports fish population. Yellow bass and black crappie are the principal game fish that frequented the lake area each summer. Good catches of largemouth bass and bluegill were often observed in the canals that transverse the marshes adjacent to Lac Des Allemands, but appreciable numbers of these two species evidently do not frequent the lake during the summer months. Channel catfish, blue catfish, flathead catfish and striped mullet were the principal commercial fish in the lake during 1961 and 1965-1967 summer samples. A small poundage of gar, carp and buffalo fish are taken in Lac Des Allemands each winter by commercial fishermen utilizing large mesh webbing. In an effort to determine the accuracy of his 1961 rotenone samples, Posey kept records of 30 days of gill net fishing by commercial fishermen in this area during the winter of 1961. Fishermen utilized 2100 feet of four and one-half inch bar mesh gill netting for 30 days and caught 44,000 pounds of buffalo fish and 15,000 pounds of gar (Schafer, 1965). This data further supports belief of seasonal movements of fish between Lac Des Allemands and adjacent lakes, canals and tributary streams.

Standing crop values of channel catfish in the lake (Tables VIII-X) revealed a high percentage of available size fish present in the summer. Available size channel catfish in these tables are fish 10 inches and above (according to standard methods of Southern Division of American Fisheries Society as adopted in 1959). This breakdown does not coincide with Louisiana regulations concerning legal lengths of catfish. The minimum length of channel catfish is 13 inches and above for Louisiana commercial fishermen. A breakdown of data from Table IX of poundages of channel catfish 13 inches and above in the summer of 1965, 1966 and 1967 reveal percentages by weight of only 18, 38 and 19 percent respectively of the total weight of channel catfish collected during these years. Posey in 1961 determined that only 10 percent of the catfish collected were of legal size.

This low poundage of marketable size catfish (yet high standing crop of catfish) warrants future study to evaluate its significance from a biological as well as a management viewpoint. Age and growth studies might yield a better understanding of the significance of the size of these catfish in this area. An attempt was made to gather some age and growth data during this study, but the number of samples collected was too small to warrant examination. It is the opinion of the author that channel catfish as well as some sunfish species such as largemouth bass and bluegill under brackish water conditions do not attain the lengths and weights experienced by the same species in more inland fresh water areas of Louisiana. If this hypothesis is valid, areas of study that might prove significant in understanding this condition include the genetics and population dynamics of fish in the brackish areas as well as limnological factors (such as temperatures, salinity and other possible physical and chemical suppressive factors).

Spawning success of fish in Lac Des Allemands during this study is revealed in Tables VIII and IX. Black crappie and channel catfish fingerling production was excellent during the study. The success of channel catfish is believed to be associated with the use of five gallon cans and large barrels in the lake by commercial fishermen each spring and summer (Schafer et al., 1966 and Davidson, 1967). These containers are placed in large quantities in a shallow area of the lake and left for a period to allow aging and location by catfish seeking spawning sites. The location of the cans is usually unmarked and the fishermen must rely on memory for relocation of his gear. Once catfish begin to frequent the cans, the fisherman dives under the water, locates the cans and either removes the fish by hand or pours the contents into a dip net handled by a fellow fisherman. If a male catfish is found protecting an egg mass, many fishermen return the can undisturbed to allow completion of hatching. Some cans are lost to fishermen due to relocation by the shifting action of winds or the lack of a proper mental record of the original location and number of cans placed in a given area. The number of unclaimed cans has built up rapidly over the past five years and has probably increased the spawning success of catfish by creating readily available spawning sites.

Davis and Posey (1959) examined 1,097 female channel catfish during the spring of 1956 and 1957 and found the majority of these Louisiana catfish reached sexual maturity between 10.5 and 11.0 inches total length. Examination of 1,125 male channel catfish revealed maturity of this sex was reached between 12.0 and 12.5 inches total length. Catfish from Lac Des Allemands and similar productive coastal lakes of

Louisiana were not included in Davis and Posey's study. The result of their study was a recommendation to lower the legal minimum size of channel catfish from the existing 14 inches total length. In 1966 this size limit was lowered to 13 inches total length. Consideration should be given to further lower this size limit to 10 inches in Lac Des Allemands and other similar coastal areas such as the Grand Lake-White Lake-Intracoastal Canal system of southwestern Louisiana. Examination of gonads of channel catfish collected in June rotenone samples during this study reveal at least 40 percent of male and female fish between 8.0 and 9.0 inches were either sexually mature or showed signs of sexual development. Occasionally a female fish of 6.5 inches total length was found with fully developed eggs. Schafer et al. (1966) also found small sexually mature channel catfish in this area. Houser and Bross (1963) in a study of channel catfish in Oklahoma waters showed a statewide average growth of 4 inches the first year and a total length of 7.5 inches by the end of the second year of growth. The fastest growing fish found by Houser and Bross in Oklahoma obtained a total length of 9.5 inches the first year and 18 inches the second year. The potential growth of Lac Des Allemands channel catfish is probably as good or better than the fastest growing Oklahoma fish of the 1963 report. It is quite possible though, that lack of adequate harvest in Lac Des Allemands (through restrictive regulations on methods of harvest and legal size limits) have resulted in a crowded channel catfish population and subsequent stunting.

Before length regulations are relaxed in Lac Des Allemands, a detailed study of the age, growth and spawning success of all catfish species in this area as well as similar coastal lakes of Louisiana should be undertaken by the Louisiana Wild Life and Fisheries Commission and other interested agencies.

Fish management recommendations that should be considered for Lac Des Allemands based on data collected during this study are:

(1) Lower the size limit from 13 inches to 10 inches for channel catfish.
(2) Open the lake to hoop nets (presently this gear is prohibited).
(3) Continue the use of slat traps, cans and large-mesh

gill webbing in the lake for commerical fishing purposes.

(4) Initiation of a detailed study of the age, growth and spawning success of all catfish species in Louisiana coastal lakes.

### *Physical and Chemical Features of Lac Des Allemands*

Results of monthly physio-chemical samples from Lac Des Allemands are presented in Figure 3 through Figure 8. Evidence of brackish conditions developing in the lake in late spring each year and persisting throughout the summer and into the fall are revealed in examination of carbonate alkalinity and pH (Figure 3) and total chlorides (Figure 5). Carbonate alkalinity values during this period ranged between 7.5 and 25.0 ppm, but usually dropped to 0.0 during the winter and early spring months. Hydrogen ion concentration ranged between 8.4 and 9.5 during the brackish period, and between 6.7 and 7.8 during the winter. Total chlorides were between 150 and 325 ppm during the summer and dropped to a range of 60-100 ppm in the winter. Bicarbonate alkalinity readings did not present any pronounced trends, ranging between 39 and 115 ppm and having a mean study value of 76.9 ppm.

Temperature, dissolved oxygen, carbon dioxide and turbidity (Figures 3 and 5) exhibited cyclic trends during the study in Lac Des Allemands. Water temperatures showed normal low winter readings with a gradual trend toward mid-summer high readings each year. Dissolved oxygen trends were reversed with high readings during winter months and low values persisting throughout the summer. Free carbon dioxide was present during the winter months when brackish conditions did not occur in the lake, but was absent in the spring and summer. The lack of free carbon dioxide during these seasons was probably due to the utilization of this gas in a carbonate form as corresponding high pH conditions prevailed throughout the summer. High turbidity values existed through the warm months and coincided closely with heavy plankton production. Turbidity was principally due to the persistant blue-green algae bloom that prevailed from April through October of each year.

Total phosphate values (Figure 6) generally coincided with high plankton production each summer and fall, while available phosphate readings were almost negative throughout the study. Total phosphate values ranged between 0.15 and 2.41 ppm during the study, with a mean value of 0.757 ppm. The high phosphate reading in June, 1966 (2.41 ppm) occurred during the same month that the Water Pollution Control Division of the Louisiana Wild Life and Fisheries Commission investigated a spillage of phosphate waste into this drainage from the Hooker Chemical Plant at Killonia (personnel communication with Thomas Gilbert, Pollution Biologist of Louisiana Wild Life and Fisheries Commission). This spillage would have eventually reached Lac Des Allemands through Bayou Fortier. This plant has been in operation since April of 1965 and has made periodic releases of phosphate waste into canals that drain into the lakes. There has been a correlative increase in the total phosphate values in Lac Des Allemands since May of 1965, as graphically shown in Figure 6, which reflects the possible influence of the phosphate waste from this commercial plant.

Nitrogen analyses for the forms in which this element is found in natural waters (ammonia, organic, nitrate and nitrite nitrogen) presented variable results as shown in Figures 7 and 8. The only significant change during the study was the abrupt increase in ammonia and organic nitrogen values in September of 1965. These values were recorded ten days following Hurricane Betsy, a destructive storm which passed inland from the Gulf of Mexico and almost directly over Lac Des Allemands. Decomposition of tree foliage, flooded marsh vegetation and debris blown into the lake and associated drainage probably caused these abrupt nitrogen changes. Reports were widespread in this drainage, as well as other areas affected by the hurricane's winds and rains of widespread loss of various fish species trapped in dead end canals and bayous. The author observed heavy fish loss in ponds and natural lakes of the Atchafalaya River Basin of southern Louisiana. Most fish were able to move downstream ahead of the toxicants into larger bodies of water where the toxic conditions were diluted. Species killed were those most susceptable to rapid chemical changes, especially gizzard and threadfin shad, and those fish trapped in inlets and dead end canals.

Mean study values for ammonia and organic nitrogen in

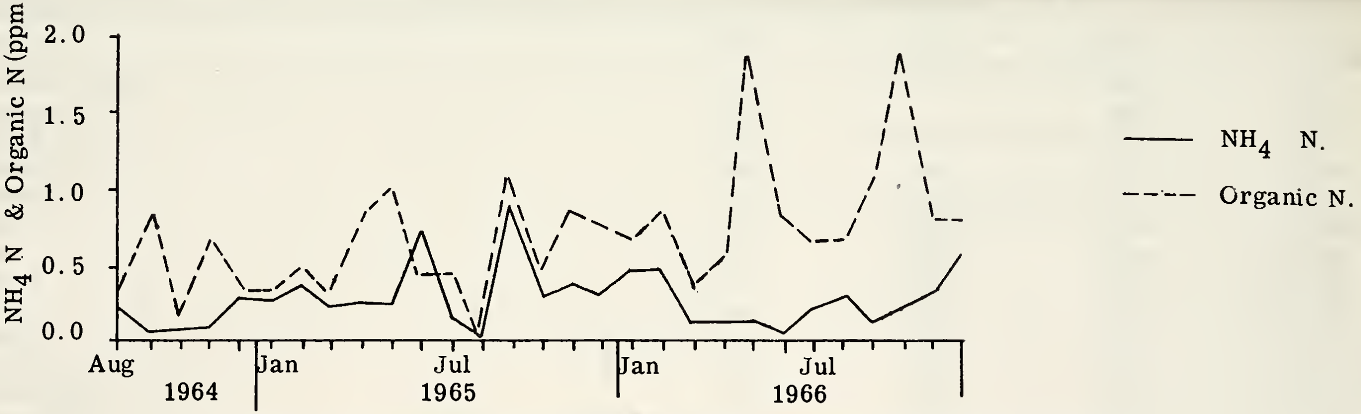

Figure 7—Monthly Variations in Ammonium and Organic Nitrogen Values in Lac Des Allemands

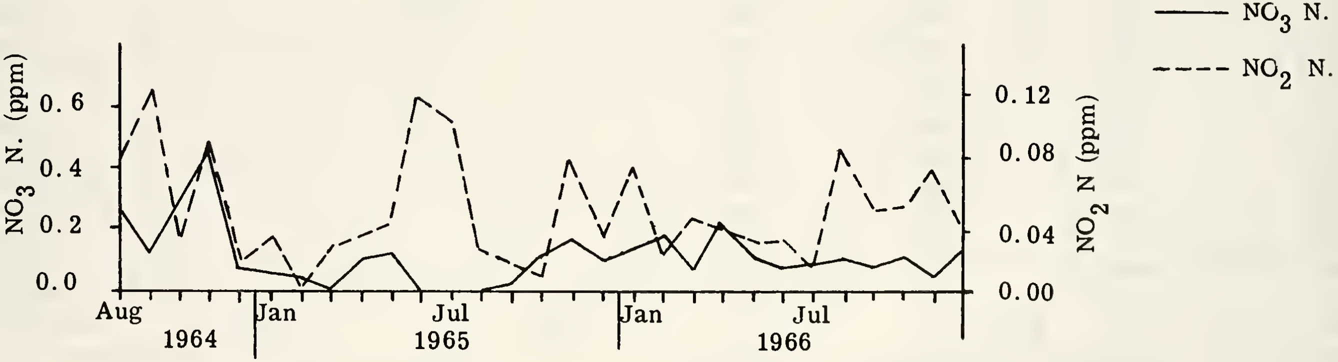

Figure 8—Monthly Variations in Nitrate and Nitrite Values in Lac Des Allemands

### Table XI
### Average Monthly Discharge Records (CFS) From Sabine River*

| | *Station I* | *Station II* | *Station III* | *Station IV* |
|---|---|---|---|---|
| August, 1964 | 133 | 155 | 392 | 642 |
| September | 82 | 105 | 308 | 536 |
| October | 171 | 172 | 346 | 504 |
| November | 112 | 116 | 394 | 576 |
| December | 328 | 438 | 1,365 | 2,700 |
| January, 1965 | 792 | 874 | 1,425 | 2,391 |
| February | 3,613 | 4,470 | 5,133 | 6,514 |
| March | 3,616 | 4,434 | 5,773 | 8,052 |
| April | 3,361 | 5,468 | 7,214 | 9,247 |
| May | 4,326 | 5,741 | 5,388 | 5,407 |
| June | 7,292 | 8,595 | 8,777 | 10,710 |
| July | 302 | 505 | 1,247 | 1,848 |
| August | 96 | 157 | 400 | 603 |
| September | 169 | 503 | 718 | 820 |
| October | 160 | 204 | 495 | 728 |
| November | 121 | 149 | 508 | 695 |
| December | 431 | 1,136 | 2,912 | 4,132 |
| January, 1966 | 675 | 1,593 | 3,425 | 5,485 |
| February | 2,603 | 9,089 | 20,040 | 24,850 |
| March | 777 | 1,512 | 3,132 | 5,152 |
| April | 3,778 | 2,863 | 3,238 | 3,738 |
| May | 29,770 | 32,310 | 31,210 | 32,980 |
| June | 1,613 | 3,396 | 6,056 | 10,320 |
| July | 219 | 288 | 909 | 1,304 |
| August | 258 | 333 | 787 | 1,204 |
| September | 594 | 630 | 879 | 1,265 |
| October ** | 299 | ... | 444 | 1,017 |
| November | 238 | ... | 483 | 1,213 |
| December, 1966 | 315 | ... | 1,409 | 1,841 |
| Study Mean | 2,284 | 3,278 | 3,959 | 5,051 |

*Records from 1964-1967 Surface Water Records of Louisiana (U. S. Dept. Interior Geology Survey)

**October 3, 1966 Closure of Sabine River at Toledo Bend Dam

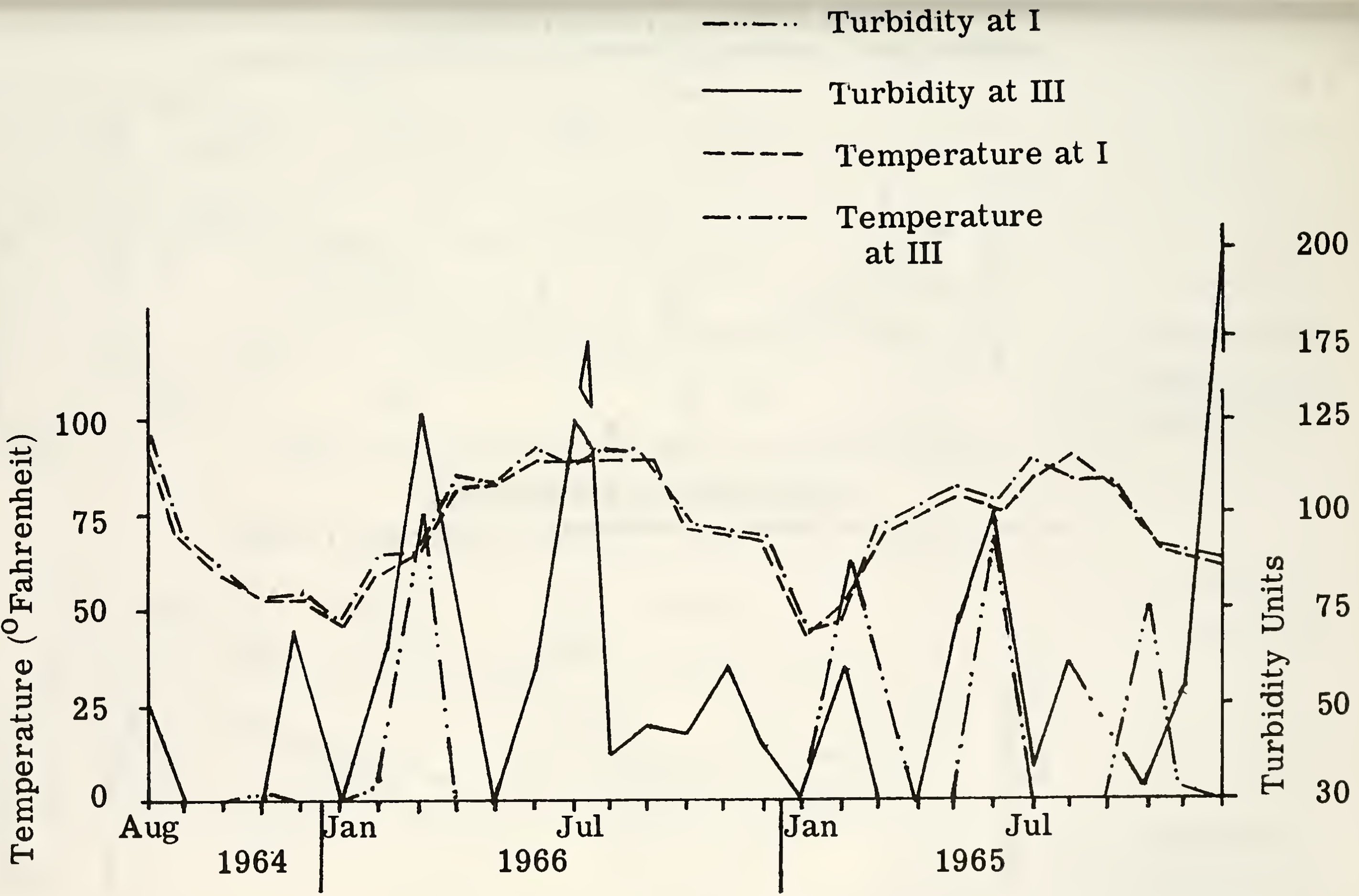

Figure 9—Monthly Variations in Turbidity and Temperature at Stations I and III of Sabine River

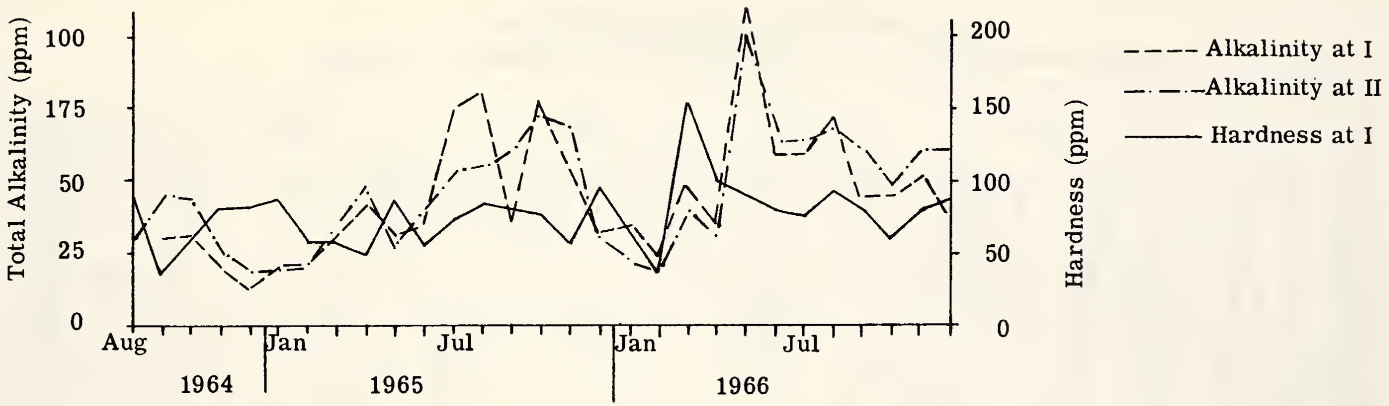

Figure 10—Monthly Variations of Alkalinity and Hardness at Stations I and II in Sabine River

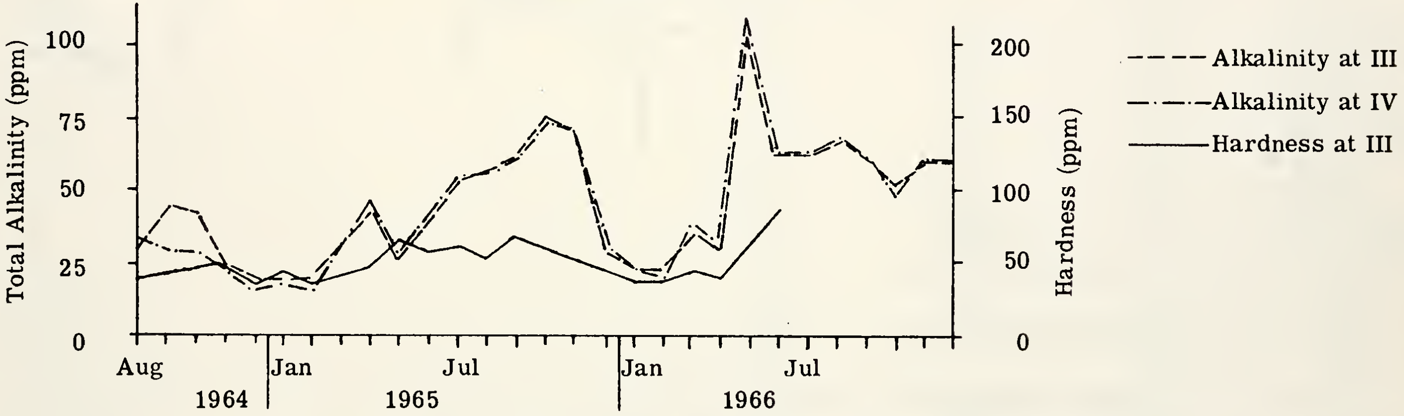

Figure 11—Monthly Variations of Alkalinity and Hardness at Stations III and IV in Sabine River

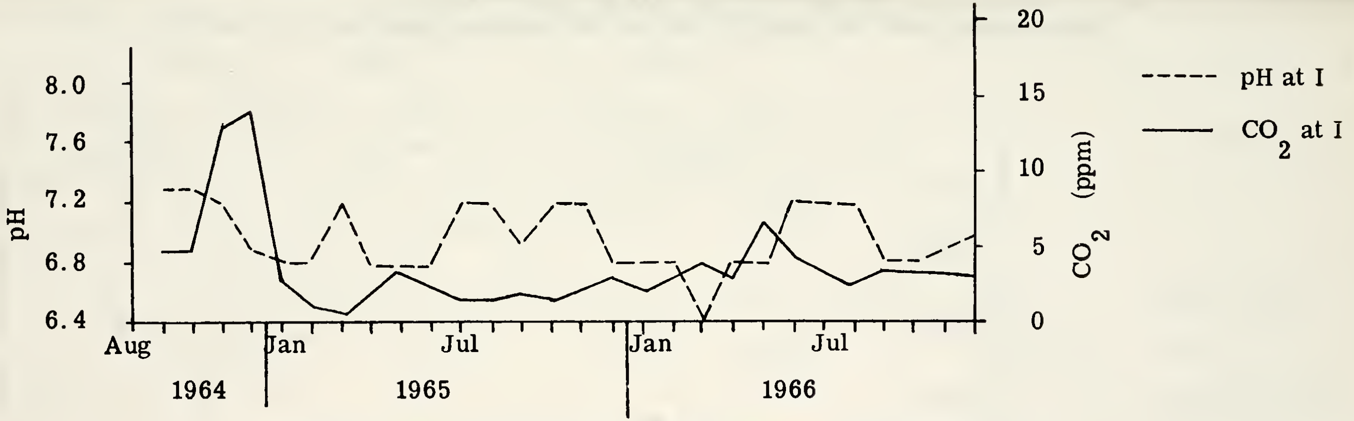

Figure 12—Monthly Variations of pH and Free CO2 From Station I of Sabine River

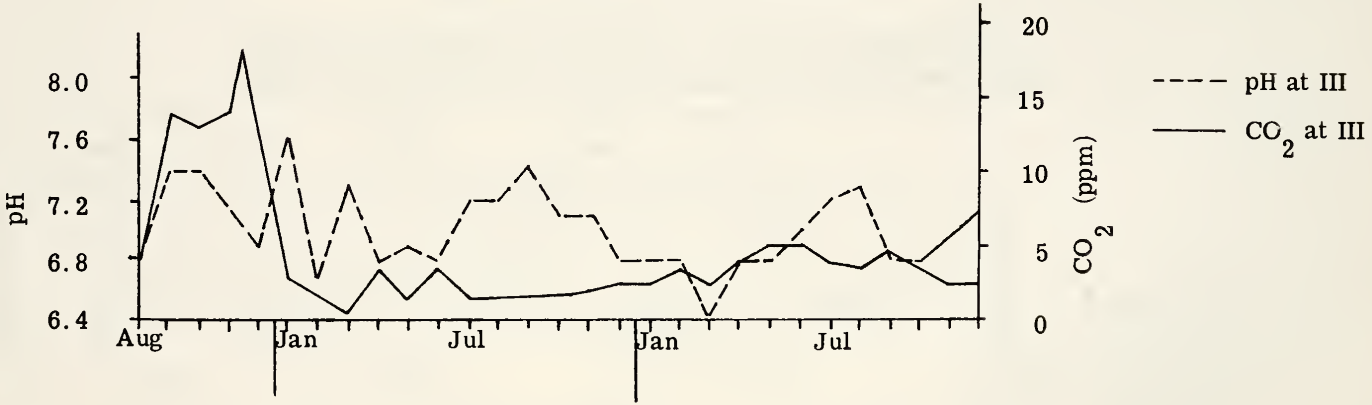

Figure 13—Monthly Variations of pH and Free CO2 From Station III of Sabine River

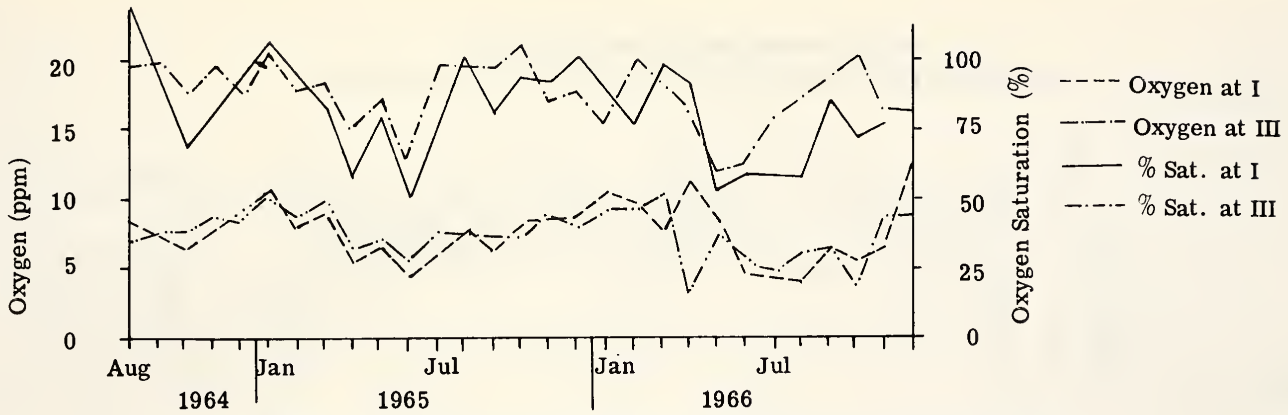

Figure 14—Monthly Variations in Dissolved Oxygen and Percent Saturation at Stations I and III of Sabine River

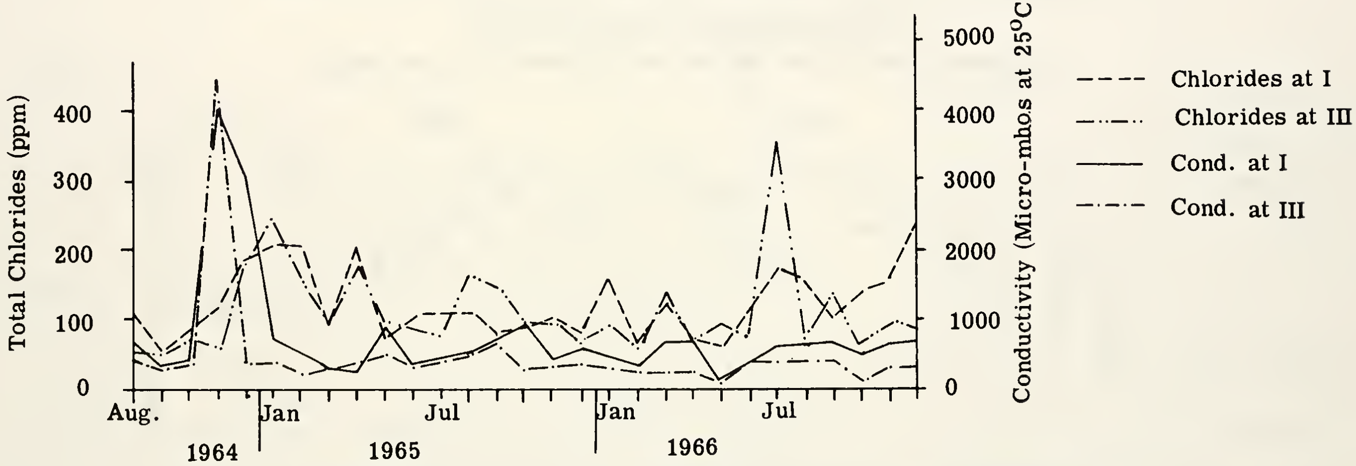

Figure 15—Monthly Variations in Total Chlorides and Conductivity at Stations I and III of Sabine River

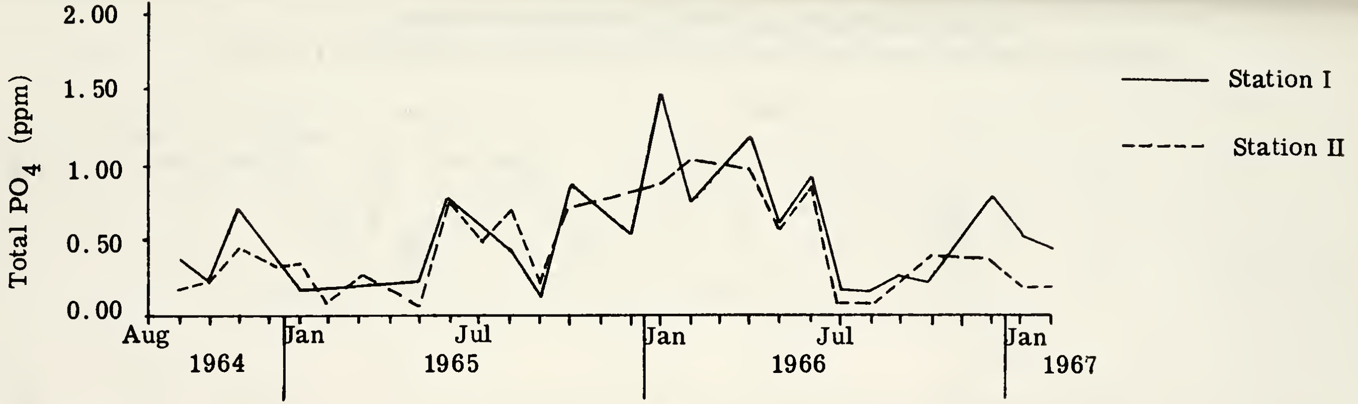

Figure 16—Monthly Variations of Total Phosphates at Stations I and II of Sabine River

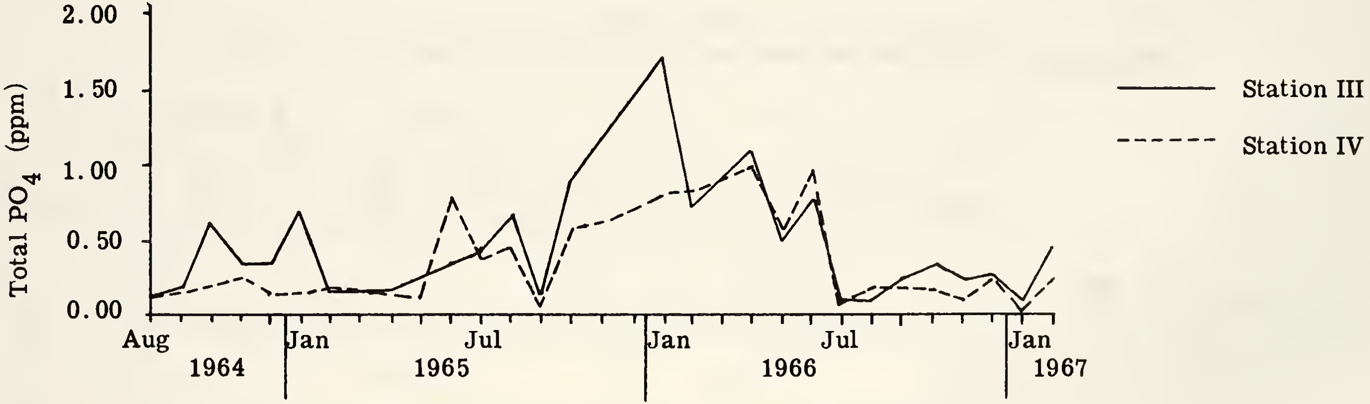

Figure 17—Monthly Variations of Total Phosphates at Stations III and IV of Sabine River

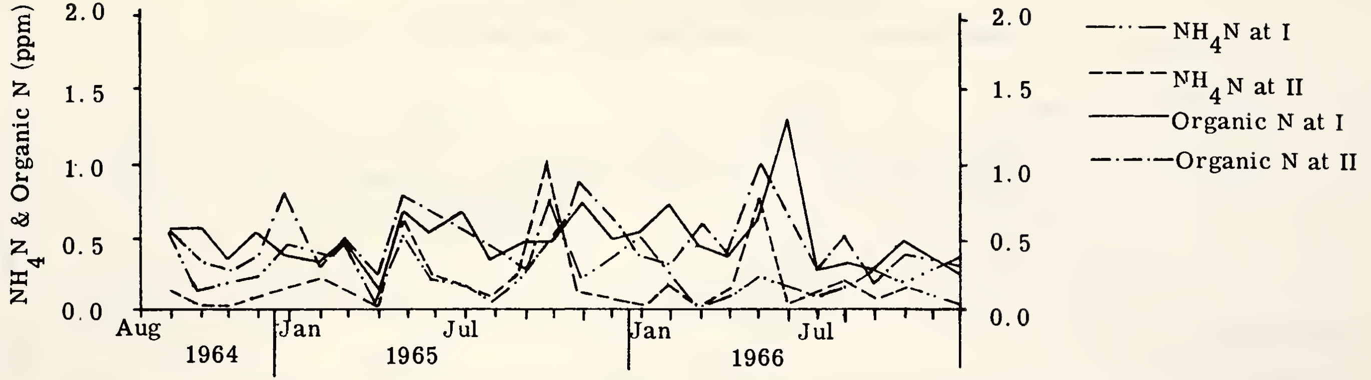

Figure 18—Monthly Variations in Ammonium and Organic Nitrogen Values at Stations I and II of Sabine River

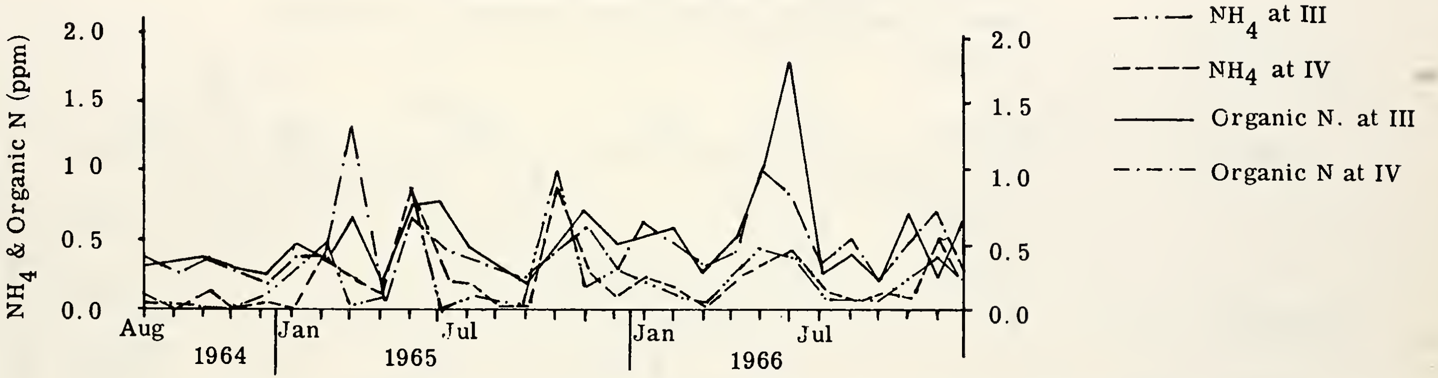

Figure 19—Monthly Variations in Ammonium and Organic Nitrogen Values at Stations III and IV of Sabine River

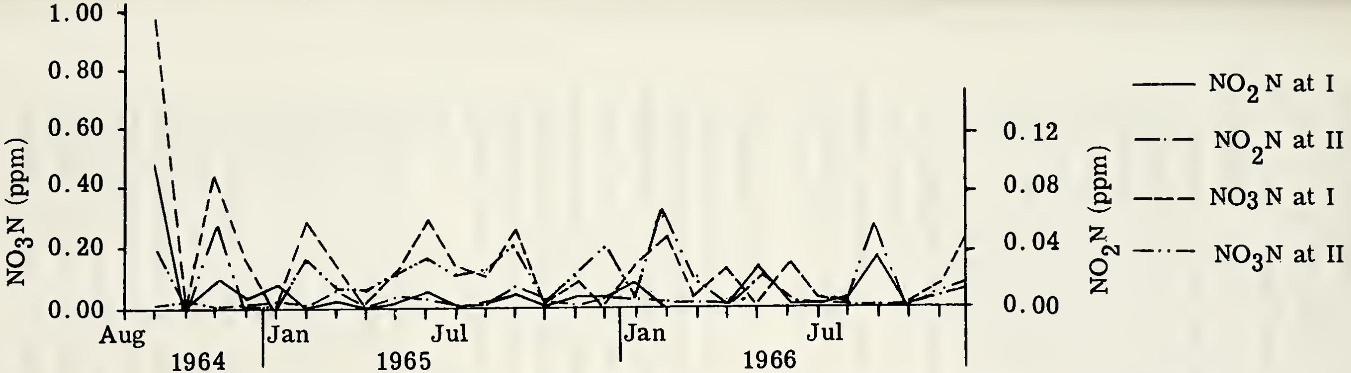

Figure 20—Monthly Variations in Nitrate and Nitrite Nitrogen Values at Stations I and II of Sabine River

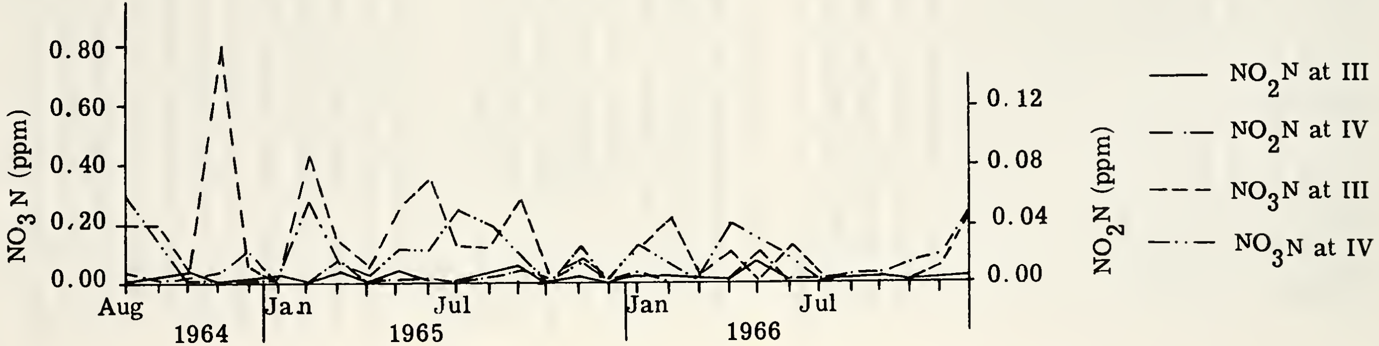

Figure 21—Monthly Variations in Nitrate and Nitrite Nitrogen Values at Stations III and IV of Sabine River

Lac Des Allemands were 0.291 and 0.716 ppm respectively. Mean study values of nitrate and nitrite nitrogen were 0.143 and 0.004 ppm, respectively for Lac Des Allemands.

### *Physical and Chemical Features of Sabine River*

The Sabine River Basin has an abundant supply of surface water of excellent quality. It is one of the few major streams in the southern part of the United States that can be classed as a clean stream and free of major domestic and industrial pollution. The drainage area of 9,700 square miles receives an average of about 48 inches of rainfall per year, of which about 13 inches flows to the Gulf of Mexico (Hughes and Leifeste, 1965). Monthly stream discharges from August, 1964 through December, 1966 are presented in Table XI as recorded in the 1964-1967 annual reports of surface water records of Louisiana as published by the U. S. Department of Interior-Geological Survey. Monthly physio-chemical results taken at the four sampling stations during the study are presented in Figures 9 through 21.

Water temperatures at each station show normal seasonal warming to the mid-80 degrees Fahrenheit in July and August and cooling to the mid-40 degrees F. in January and February of each year (Figure 9). Turbidity readings at Station I were less than 30 turbidity units most of the year, with sporadic increases to 100 units as rains created muddy conditions. Average monthly turbidities were greater downstream at Station III, with values ranging normally between 40 and 60 units and readings as high as 200 units accompanying increased stream discharges.

Alkalinity values from all four stations (Figures 10 and 11) were always in the form of bicarbonate alkalinity and ranged between 12 and 35 ppm during periods of low stream discharge and 70 and 100 ppm during periods of high stream discharge. The mean bicarbonate alkalinity values of Station I through Station IV were 45.6, 48.1, 45.0 and 44.0 ppm respectively. Total hardness measured at Station I and Station III were similarly influenced by stream discharge rates with low values ranging between 30 and 50 ppm calcium carbonate and high values ranging between 80 and 150 ppm (Figure 11). Hughes and Leifeste (1965) found similar values and classified the Sabine River water as soft, having less than 60 ppm hardness except where Cretaceous rock out crops resulted in moderate hardness (60-120 ppm) as heavy rainfalls and river discharges eroded these formations. The southern one-third of the Sabine River Basin was classified as very soft, with less than 30 ppm hardness.

Free carbon dioxide was usually found in small amounts ranging between 1.0 and 4.5 ppm (Figures 12 and 13). Mean study values for the stations in a downstream order were 3.7, 3.4, 4.3 and 4.8 ppm respectively. Hydrogen ion concentration tended toward low winter values between 6.8 and 7.0 and high summer values ranging between 7.2 and 7.4 at all four stations in a downstream order were 7.0, 7.1, 7.0 and 7.0 respectively.

Dissolved oxygen at all four stations showed a normal tendency of high values ranging between 8 and 10 ppm during winter months, and low summer values ranging between 4 and 7 ppm (Figure 14). Calculation of percent saturation of oxygen for Stations I and III also revealed similar winter high and summer low values (Figure 14).

Total chloride and specific conductivity values from Stations I and III are presented in Figure 15. Chlorides ranged between 47 and 358 ppm during this study with mean study values of 121 ppm for Station I and 110 for Station II. Specific conductivity ranged between 149 and 4,500 micromhos at Stations I and III, with mean values of 756 and 498 respectively. Both of these measurements reveal the influence of brine from oilfields in the upper Texas drainage and recently developed Pendleton oilfield of Sabine Parish, Louisiana. McDaniel (1968) found the Pendleton oilfield development has increased the total chloride content in Bayou Negreet to 976 ppm as opposed to the 2 to 12 ppm range found by Lantz (1962) in this Sabine River tributary. Hughes and Leifeste (1965) indicate that the East Texas oilfield discharges and natural salt water pollution from a surface salt dome in Van Zandt County, Texas influence the total chloride contents of the upper Sabine River. This study agrees with these findings that the total chlorides between Logansport, Louisiana and Starks, Louisiana range between 101 and 250 ppm, and there is a gradual decrease in chlorides downstream between these two areas.

Nitrogen values (ammonia, organic, nitrate and nitrite nitrogen) in the Sabine did not reveal any seasonal trends (Figures 18 through 21). Ammonia nitrogen values from the four stations ranged from 0.0 to 0.980 ppm, with mean study values of 0.297, 0.184, 0.226 and 0.193 ppm respectively in, downstream order of occurrence. Ranges in organic nitrogen values were from 0.188 to 1.784, with mean study values in a downstream order of 0.489, 0.489, 0.455 and 0.425 ppm respectively. Nitrate nitrogen values ranged between 0.0 and 0.980, similar to the 0.0 to 2.0 ppm found by Hughes and Leifeste in 1965. The mean study values of nitrate nitrogen for the four stations of this study in downstream order of their occurrence are 0.168, 0.135, 0.147 and 0.115 ppm. Nitrite nitrogen values from the four stations ranged from 0.0 to 0.100 ppm with mean study values of 0.013, 0.008, 0.005, and 0.005 in a downstream order of occurrence.

Available phosphates were seldom recorded in monthly samples from the Sabine River. Total phosphate results showed a tendency toward maximum occurrences at all fur stations between October, 1965 and June, 1966, but erratic results were recorded during other periods of the study. Mean study values for the four stations in a downstream order were 0.502, 0.417, 0.433 and 0.345 ppm total phosphates.

Results of water quality studies during this project are very similar to that found by Hughes and Leifeste (1965). Variations in the chemical quality of the surface waters in the Sabine River Basin are caused principally by area differences in geology and runoff; but industrial influence, particularly the disposal of oil-field brines, affect the quality in limited areas. Water having the least dissolved solids is found in the lower part of the basin, where rainfall is greatest. Water having higher values of hardness are found in the areas of Cretaceous limestone, chalk and marl in the upper part of the drainage. Chloride concentrations are generally low except where streams are polluted by oil-field brines and localized natural saline inflow. The water quality in Toledo Bend Reservoir should be of good quality if brine releases are not allowed to increase or are reduced through the use of injection wells.

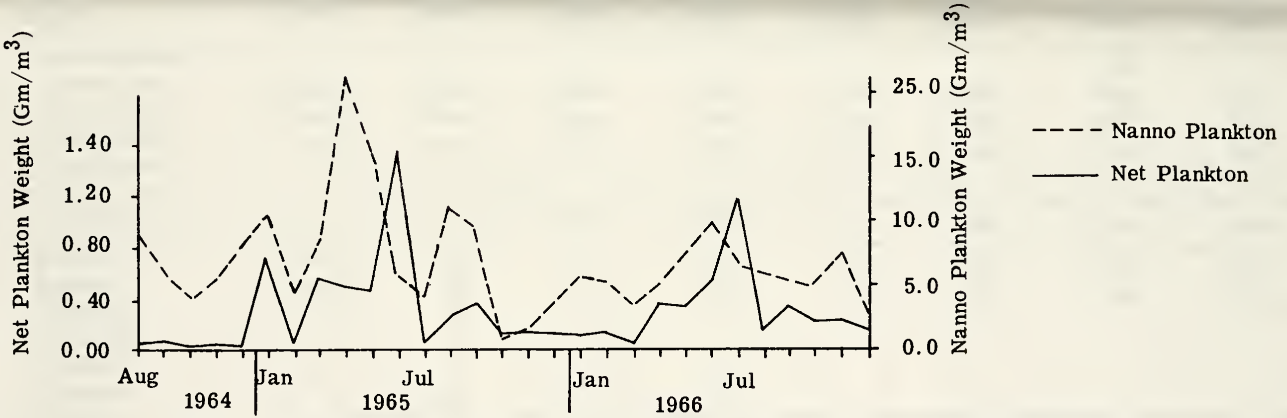

Figure 22—Monthly Variations of Net and Namo Plankton Weights Per Cubic Meter in Lac Des Allemands

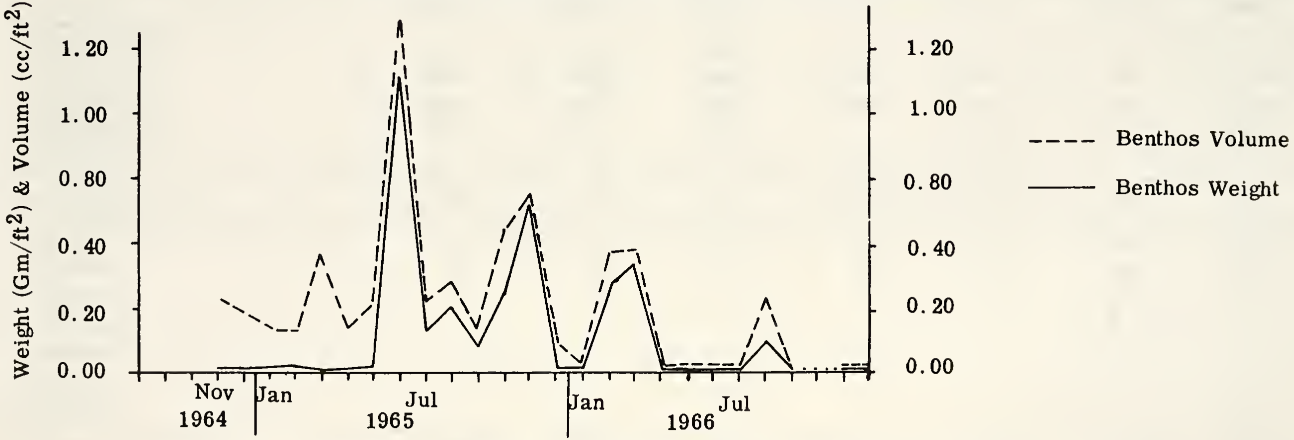

Figure 23—Monthly Variance of Weight (Gm/ft2) and Volume (cc/ft2) of Bottom Fauna from Lac Des Allemands

### Table XII
## MONTHLY NET PLANKTON COUNTS PER LITER FROM LAC DES ALLEMANDS

| | 1964 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Organism* | *Aug.* | *Sept.* | *Oct.* | *Nov.* | *Dec.* | *Jan.* | *Feb.* | *Mar.* |
| *Zooplankton* | | | | | | | | |
| Protozoa | .. | .. | .. | .. | .. | .. | 100 | 400 |
| Cladocera | .. | .. | .. | .. | .. | .. | 1 | 1 |
| Ostracoda | 1 | 1 | 2 | .. | .. | .. | .. | .. |
| Copepoda | .. | .. | .. | 1 | 1 | 11 | 6 | 19 |
| Nauplius | 10 | 4 | 1 | 8 | 3 | 29 | 50 | 61 |
| Rotifera | 150 | 33 | 100 | 33 | 100 | 100 | 300 | 714 |
| TOTAL | 161 | 38 | 103 | 42 | 104 | 140 | 457 | 1195 |
| *Phytoplankton* | | | | | | | | |
| Chlorophyta | 6700 | 3800 | 1800 | ... | 300 | 300 | 1500 | 5100 |
| Chrysophyta | 2000 | 3500 | 800 | 200 | 100 | 1100 | 200 | 1100 |
| Cyanophyta | 12800 | 8800 | 3600 | 100 | 100 | 500 | 300 | 900 |
| Euglenophyta | 300 | 100 | 500 | ... | ... | ... | ... | ... |
| TOTAL | 21800 | 16200 | 6700 | 300 | 500 | 1900 | 2000 | 7200 |

| | 1965 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Zooplankton* | *Apr.* | *May* | *June* | *July* | *Aug.* | *Sept.* | *Oct.* | *Nov.* | *Dec.* |
| Protozoa | .. | 100 | .. | .. | .. | .. | .. | .. | .. |
| Cladocera | 203 | 41 | 69 | 6 | .. | 1 | 1 | .. | 2 |
| Ostracoda | ... | .. | 1 | .. | .. | .. | .. | .. | .. |
| Copepoda | 76 | 55 | 5 | .. | .. | 89 | .. | .. | 8 |
| Nauplius | 532 | 230 | 79 | 18 | 5 | 210 | 150 | 118 | 65 |
| Rotifera | 1600 | 480 | 2100 | 1500 | 1100 | 300 | 1350 | 1600 | 366 |
| TOTAL | 2411 | 896 | 2254 | 1524 | 1105 | 600 | 1501 | 1718 | 431 |
| *Phytoplankton* | | | | | | | | | |
| Chlorophyta | 1600 | 5200 | 1000 | 1500 | 900 | 1100 | 500 | 1800 | 1900 |
| Chrysophyta | 1400 | 2800 | 100 | 400 | 200 | 800 | 500 | 450 | 800 |
| Cyanophyta | 22500 | 14200 | 32900 | 34000 | 25100 | 33300 | 4000 | 4800 | 1900 |
| Euglenophyta | | ..... | ..... | ..... | ..... | ..... | 50 | .... | .... |
| TOTAL | 25500 | 22200 | 34000 | 35900 | 26200 | 35200 | 5050 | 7050 | 4600 |

| | 1966 | | | | | | | | | | | | 1967 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Organism* | *Jan.* | *Feb.* | *March* | *Apr.* | *May* | *June* | *July* | *Aug.* | *Sept.* | *Oct.* | *Nov.* | *Dec.* | *Jan.* |
| *Zooplankton* | | | | | | | | | | | | | |
| Protozoa | .. | .. | .. | .. | .. | ... | .. | .. | .. | .. | .. | .. | .. |
| Cladocera | 2 | 2 | 3 | 86 | 341 | 486 | 2840 | 118 | 66 | .. | 18 | 126 | 228 |
| Ostracoda | .. | .. | .. | .. | ... | ... | .... | ... | .. | .. | .. | ... | ... |
| Copepoda | 2 | 12 | 2 | 64 | 124 | 120 | 120 | 2 | .. | .. | .. | 5 | 42 |
| Nauplius | 13 | 129 | 162 | 109 | 374 | 466 | 51 | 33 | 10 | .. | 15 | 96 | 184 |
| Rotifera | .. | 200 | 500 | 500 | 1000 | 600 | 1500 | 200 | 1200 | .. | 1100 | 1000 | 700 |
| TOTAL | 17 | 343 | 667 | 759 | 1839 | 1672 | 4511 | 553 | 1276 | * | 1133 | 1227 | 1154 |
| *Phytoplankton* | | | | | | | | | | | | | |
| Chlorophyta | 800 | 1500 | 3200 | 2100 | 1400 | 1200 | 6500 | 1900 | 5400 | .. | 7300 | 5700 | 87100 |
| Chrysophyta | 100 | 100 | 200 | 300 | 400 | 300 | 500 | 300 | 900 | .. | 1100 | 1100 | 2200 |
| Cyanophyta | 700 | 1300 | 400 | 900 | 2700 | 10800 | 30000 | 5900 | 47400 | .. | 15500 | 7900 | 6600 |
| Euglenophyta | ... | .... | ... | ... | .... | ..... | ..... | .... | ..... | .. | ..... | .... | ..... |
| TOTAL | 1600 | 2900 | 3800 | 3300 | 4500 | 12300 | 37000 | 8100 | 53700 | .. | 23900 | 14700 | 95900 |

*Not sampled

### *Net and Nanno Plankton Production in Lac Des Allemands*

Monthly counts and weights of net and nanno plankton from Lac Des Allemands are presented in Table XII and Figure 22. Minimum net plankton counts and weights occurred during the fall and winter of each year. Net plankton production increased gradually in early spring to maximum June counts and weights. Cladocera and Rotifera were the principal zooplankton groups and Cyanophyta and Chlorophyta were the principal phytoplankton groups in these counts and weights from Lac Des Allemands. The project mean net plankton weight was 0.311 grams per cubic meter during the two and one-half year sampling period. This is similar to the 0.380 grams/$m^3$ recorded by Geagan and Allen (1960) in Cane River Lake, the most productive of four Louisiana natural oxbow and impounded lakes.

Nanno plankton gravimetric results (Figure 22) revealed maximum summer and early fall values, with January pulses each year. The mean gravimetric value of nanno plankton for the two and one-half years of sampling was 7.139 grams per cubic meter. This mean value is higher than the mean results (5.50 g/$m^3$) reported by Geagan and Allen (1960) in Cane River Lake. The project mean total plankton gravimetric value for Lac Des Allemands (net plus nanno plankton mean values) was 7.450 gm/$m^3$, considerably higher than mean values found by Geagan and Allen (1960) and Lantz (1967) in their studies of oxbow, backwater and impounded lakes of central and northern Louisiana.

Monthly chlorophyll and carotenoid pigment determinations were made during the study to assist in evaluating phytoplankton productivity. The results of these values are presented in Table XIII, with chlorophyll a and b measured in milligrams per liter and chlorophyll c, carotenoid ac and nac recorded as milligrams specific pigment units according to methods outlined by Richards and Thompson (1952). Chlorophyll a, b and c pigments revealed pronounced spring increases each year to summer maximum values, with high values extending through early fall. These chlorophyll pigments seasonal trends coincided with phytoplankton counts of Chlorophyta and Cyanophyta presented in Table XII.

## TABLE XIII

## PHYTOPLANKTON PIGMENTS FROM LAC DES ALLEMANDS*

| *Month* | *Chlorophyll a* | *Chlorophyll b* | *Chlorophyll c* | *Carotenoid ac* | *Carotenoid nac* |
|---|---|---|---|---|---|
| August, 1964 | 5.92 | 1.77 | 5.64 | 0.96 | 0.80 |
| September | 7.06 | 2.37 | 6.11 | 1.41 | 0.77 |
| October | 8.60 | 2.97 | 4.48 | 1.08 | 1.53 |
| November | 1.99 | 2.78 | 6.00 | 1.91 | 4.13 |
| December | 3.18 | 2.24 | 6.00 | 1.35 | 2.52 |
| January, 1965 | 4.93 | 2.58 | 6.30 | 1.28 | 1.84 |
| February | 5.64 | 1.71 | 5.22 | 1.10 | 1.26 |
| March | 12.30 | 4.01 | 9.99 | 1.86 | 2.01 |
| April | 43.23 | 11.18 | 9.49 | 8.36 | 2.69 |
| May | 12.01 | 7.51 | 9.27 | 1.23 | 2.25 |
| June | 15.90 | 11.64 | 13.56 | 1.88 | 2.39 |
| July | 7.11 | 6.35 | 5.41 | 0.89 | 0.97 |
| August | 9.33 | 7.46 | 4.22 | 1.81 | 1.48 |
| September | 24.36 | 20.61 | 2.26 | 2.79 | 2.09 |
| October | .... | .... | ... | ... | ... |
| November | 3.54 | 3.36 | 2.31 | 0.22 | 1.08 |
| December | 5.42 | 3.77 | 1.78 | 0.40 | 1.31 |
| January, 1966 | 3.04 | 2.58 | 0.40 | 0.33 | 0.66 |
| February | 3.91 | 3.44 | 3.96 | 0.55 | 0.67 |
| March | 3.54 | 2.63 | 1.97 | 0.36 | 0.41 |
| April | ... | ... | ... | ... | ... |
| May | 6.12 | 5.27 | 3.75 | 0.68 | 1.41 |
| June | 10.04 | 10.68 | 9.09 | 1.06 | 1.31 |
| July | 9.80 | 9.91 | 8.36 | 1.41 | 1.28 |
| August | 22.11 | 22.70 | 22.43 | 1.46 | 0.66 |
| September | 12.82 | 11.20 | 14.16 | 1.36 | 1.41 |
| October | 10.01 | 8.27 | 8.24 | 1.93 | 0.83 |
| November | 8.96 | 9.16 | 7.85 | 1.36 | 1.60 |
| December, 1966 | 11.38 | 10.14 | 12.32 | 1.94 | 0.85 |
| Mean | 10.083 | 6.974 | 7.058 | 1.517 | 1.489 |

*Milligram per liter (mg/1)—chlorophyll a and chlorophyll b values

Milligram specific pigment units (MSPU)—chlorophyll c, carotenoid ac and carotenoid nac values.

Maximum phytoplankton counts beginning in late spring and extending through the summer and into the fall were principally due to Cyanophyta species, and to a lesser extent to Chlorophyta species (Table XII). Laboratory examination of phytoplankton during this study was designed to carry identification only to major groups, therefore, an evaluation of only the generic significance of these major phytoplankton forms can be made. *Microcystis, Anabaena, Anabaenopsis* and *Spirulina* were the genera of Cyanophyta that always occurred in high numbers during the summer maximum phytoplankton counts. *Microcytis* was the dominant genera of the blue-green algae. The four common Chlorophyta genera were *Pediastaum, Scenedesmus, Staurastrum* and *Closteriopsis. Pediastaum* was the dominant green algae in counts of phytoplankton each spring, summer and fall.

Throughout the spring, summer and fall of each year Lac Des Allemands exhibited a characteristic blue-green color indicative of its heavy bloom of *Microcystis.* In July and August of each year, the surface occurrence of this blue-green algae was so great that a one to two inch thick surface mat of *Microcystis* was formed in wind created drift areas of the lake. Numerous investigators have reported such concentrated scums of blue-green algae and most observers attribute this surface occurrence to the presence of oil droplets and air vacuoles during certain growth stages of the algae cells. Edmondson et al. (1967) discussed the nutritional significance of surface scums of blue-green algae environmental symposium in Oregon. Two interesting points that came forth from this symposium were that most blue-green algae absorb their nutrients in the bottom waters before floating to the surface, and competition increases at the surface layer of water between the dominant algae species and other plankton forms as nutrients such as nitrogen and phosphorous became limited.

The persistant late spring to fall bloom of blue-green algae in Lac Des Allemands during this study is well documented in monthly results of plankton counts, weights, pigments and turbidity values (Figures 5 and 22 and Tables XII and XIII). Species of Chlorophyta, Chrysophyta, and Euglenophyta were present at all times during the study, but always in much lower numbers than blue-green algae species during the major bloom

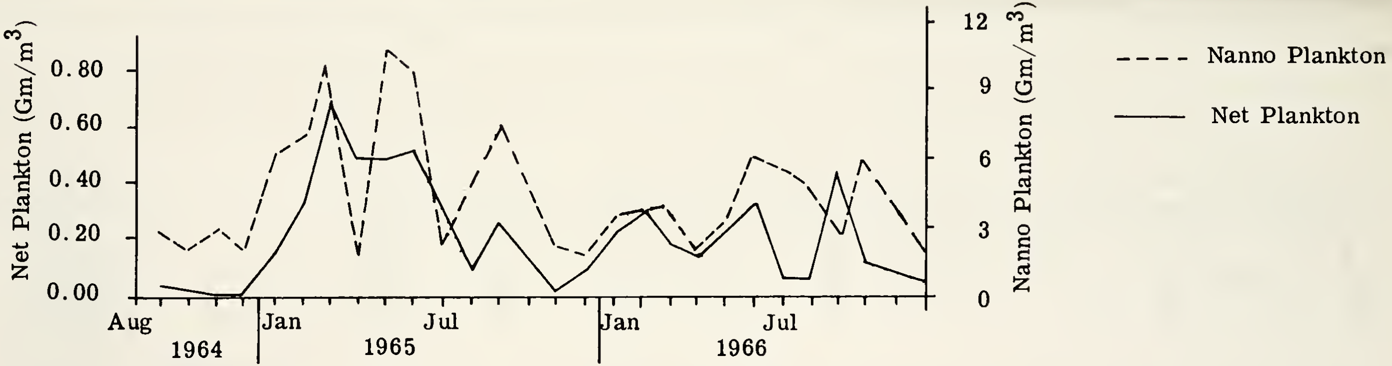

Figure 24—Monthly Variations of Weight (Gm/m3) of Net and Nano Plankton at Station I of Sabine River

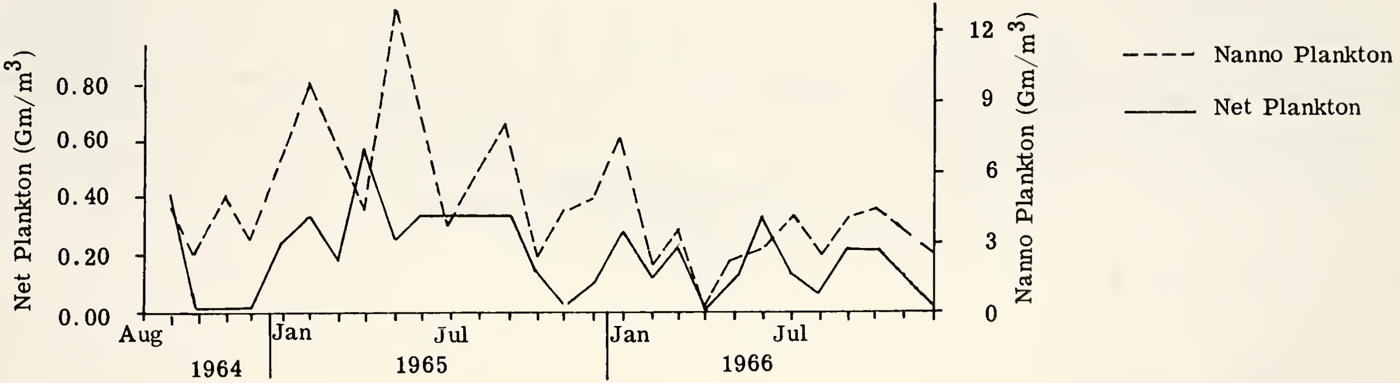

Figure 25—Monthly Variations of Weight (Gm/m3) of Net and Nano Plankton at Station II of Sabine River

### Table XIV
### MONTHLY NET PLANKTON COUNTS PER LITER FROM SABINE RIVER I

| | *1964* | | | | *1965* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Organism* | *Sept.* | *Oct.* | *Nov.* | *Dec.* | *Jan.* | *Feb.* | *Mar.* | *Apr.* | *May* | *June* | *July* | *Aug.* | *Sept.* | *Oct.* | *Nov.* | *Dec.* |
| *Zooplankton* | | | | | | | | | | | | | | | | |
| Cladocera | .. | .. | .. | .. | .. | .. | .. | 4 | 2 | .. | .. | .. | .. | .. | .. | .. |
| Copepoda | .. | .. | .. | .. | .. | 3 | .. | 4 | .. | .. | .. | .. | 7 | .. | .. | .. |
| Nauplius | .. | .. | .. | .. | 1 | 5 | 1 | 4 | 1 | .. | .. | .. | 12 | .. | .. | 5 |
| Rotifera | .. | .. | .. | .. | .. | 200 | 100 | 1000 | .. | .. | .. | .. | .. | .. | .. | .. |
| TOTAL | 0 | 0 | 0 | 0 | 1 | 208 | 101 | 1012 | 3 | 0 | 0 | 0 | 19 | 0 | 0 | 5 |
| *Phytoplankton* | | | | | | | | | | | | | | | | |
| Chlorophyta | 300 | ... | 300 | ... | 100 | 100 | 100 | 600 | ... | ... | ... | 100 | 200 | ... | 100 | 300 |
| Chrysophyta | 100 | ... | 300 | ... | ... | 300 | ... | 100 | 600 | 200 | ... | ... | 500 | 600 | ... | 300 |
| Cyanophyta | 600 | ... | ... | ... | ... | ... | ... | 300 | ... | ... | 100 | ... | ... | ... | ... | ... |
| Euglenophyta | 200 | ... | 100 | ... | 100 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| TOTAL | 1200 | 0 | 700 | 0 | 200 | 400 | 100 | 1000 | 600 | 200 | 100 | 100 | 700 | 600 | 100 | 600 |

| Organism | 1966 Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | 1967 Jan. | Mar. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Zooplankton* | | | | | | | | | | | | | | |
| Cladocera | 2 | .. | .. | 3 | 4 | .. | .. | .. | .. | 1 | .. | 5 | 12 | 1 |
| Copepoda | .. | .. | .. | 4 | 5 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Nauplius | 1 | .. | .. | 19 | 28 | .. | .. | 1 | 1 | .. | .. | .. | .. | .. |
| Rotifera | .. | .. | .. | 300 | .. | .. | 100 | 100 | .. | 100 | .. | .. | .. | .. |
| TOTAL | 3 | 0 | 0 | 326 | 37 | 0 | 100 | 101 | 1 | 101 | * | 5 | 12 | 1 |
| *Phytoplankton* | | | | | | | | | | | | | | |
| Chlorophyta | 100 | ... | 300 | 100 | 300 | ... | ... | ... | 400 | 500 | ... | ... | 900 | 1700 |
| Chrysophyta | 2800 | 900 | 1500 | 600 | ... | 500 | ... | ... | 600 | 2500 | ... | 500 | 900 | .... |
| Cyanophyta | ... | ... | .... | ... | ... | ... | 200 | ... | ... | .... | ... | ... | ... | .... |
| Euglenophyta | ... | ... | .... | ... | ... | ... | ... | ... | ... | .... | ... | ... | ... | .... |
| TOTAL | 2900 | 900 | 1800 | 700 | 300 | 500 | 200 | 201 | 1000 | 3000 | * | 500 | 1800 | 1700 |

*Not sampled

### Table XV
### MONTHLY NET PLANKTON COUNTS PER LITER FROM SABINE RIVER II

| | 1964 | | | | 1965 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Organism* | *Sept.* | *Oct.* | *Nov.* | *Dec.* | *Jan.* | *Feb.* | *Mar.* | *Apr.* | *May* | *June* | *July* | *Aug.* | *Sept.* | *Oct.* | *Nov.* | *Dec.* |
| *Zooplankton* | | | | | | | | | | | | | | | | |
| Cladocera | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | ... | ... |
| Copepoda | .. | .. | .. | .. | .. | 1 | .. | 12 | 1 | .. | .. | .. | 4 | .. | ... | ... |
| Nauplius | .. | 1 | .. | .. | .. | 4 | .. | 9 | 4 | 1 | .. | .. | .. | .. | ... | ... |
| Rotifera | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 100 | 100 |
| TOTAL | 0 | 1 | 0 | 0 | 0 | 5 | 0 | 22 | 5 | 1 | .. | .. | 4 | 0 | 100 | 100 |
| *Phytoplankton* | | | | | | | | | | | | | | | | |
| Chlorophyta | 1100 | 500 | 100 | 100 | 100 | 400 | 500 | 1800 | 100 | 200 | ... | ... | ... | 100 | ... | ... |
| Chrysophyta | 600 | 100 | 500 | ... | 100 | ... | 300 | 400 | 100 | 200 | ... | ... | 300 | ... | 100 | 200 |
| Cyanophyta | 1600 | 500 | 200 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Euglenophyta | ... | ... | ... | ... | 100 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| TOTAL | 3300 | 1100 | 700 | 100 | 300 | 400 | 800 | 2200 | 200 | 400 | ... | ... | 300 | 100 | 100 | 200 |

| | 1966 | | | | | | | | | | | | 1967 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Organism* | *Jan.* | *Feb.* | *Mar.* | *Apr.* | *May* | *June* | *July* | *Aug.* | *Sept.* | *Oct.* | *Nov.* | *Dec.* | *Jan.* | *Mar.* |
| *Zooplankton* | | | | | | | | | | | | | | |
| Cladocera | ... | .. | 3 | .. | .. | 14 | ... | .. | .. | 1 | .. | 5 | 5 | .. |
| Copepoda | ... | 3 | 4 | 14 | .. | 3 | ... | .. | .. | 1 | .. | .. | .. | .. |
| Nauplius | ... | .. | .. | .. | .. | 16 | ... | .. | 1 | .. | .. | .. | .. | .. |
| Rotifera | ... | .. | .. | .. | .. | .. | 100 | .. | .. | .. | .. | .. | .. | .. |
| TOTAL | 0 | 3 | 7 | 14 | 0 | 33 | 100 | 0 | 1 | 2 | * | 5 | 5 | 0 |
| *Phytoplankton* | | | | | | | | | | | | | | |
| Chlorophyta | ... | ... | ... | ... | ... | ... | ... | 400 | 400 | ... | ... | ... | 700 | 15100 |
| Chrysophyta | 400 | 200 | 100 | 100 | ... | 400 | ... | 600 | 300 | 200 | ... | 200 | 200 | 1400 |
| Euglenophyta | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 200 |
| Cyanophyta | ... | ... | ... | ... | ... | ... | 30 | ... | 200 | ... | ... | ... | ... | ... |
| TOTAL | 400 | 200 | 100 | 100 | ... | 400 | 30 | 1000 | 900 | 200 | * | 200 | 900 | 16700 |

*Not sampled

## TABLE XVI
## MONTHLY NET PLANKTON COUNTS PER LITER FROM SABINE III

| Organism | 1964 | | | | 1965 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Sept.* | *Oct.* | *Nov.* | *Dec.* | *Jan.* | *Feb.* | *Mar.* | *Apr.* | *May* | *June* | *July* | *Aug.* | *Sept.* | *Oct.* | *Nov.* | *Dec.* |
| *Zooplankton* | | | | | | | | | | | | | | | | |
| Cladocera | 1 | .. | .. | .. | .. | .. | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Copepoda | 1 | .. | .. | .. | .. | 1 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Nauplius | .. | .. | .. | .. | .. | 4 | .. | .. | 1 | .. | .. | .. | .. | .. | .. | 2 |
| Rotifera | .. | .. | .. | .. | .. | 200 | 500 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| TOTAL | 2 | 0 | 0 | 0 | 0 | 205 | 505 | .. | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Phytoplankton* | | | | | | | | | | | | | | | | |
| Chlorophyta | 700 | 500 | ... | ... | 300 | 200 | 500 | 1100 | 700 | 500 | ... | ... | ... | 500 | 100 | 400 |
| Chrysophyta | 100 | 200 | ... | ... | ... | 300 | 400 | 300 | 400 | 400 | ... | 100 | 100 | ... | 200 | ... |
| Cyanophyta | 300 | 100 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Euglenophyta | 300 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| TOTAL | 1400 | 800 | 0 | 0 | 300 | 500 | 900 | 1400 | 1100 | 900 | ... | 100 | 100 | 500 | 300 | 400 |

| | 1966 | | | | | | | | | | | | 1967 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Organism* | *Jan.* | *Feb.* | *Mar.* | *Apr.* | *May* | *June* | *July* | *Aug.* | *Sept.* | *Oct.* | *Nov.* | *Dec.* | *Jan.* | *Mar.* |
| *Zooplankton* | | | | | | | | | | | | | | |
| Cladocera | | .. | 1 | 1 | 1 | 1 | 1 | .. | .. | .. | 5 | 16 | .. | .. |
| Copepoda | | 1 | 1 | .. | 1 | .. | .. | .. | 1 | .. | 3 | .. | .. | .. |
| Nauplius | | 3 | 2 | 5 | 7 | .. | .. | .. | .. | .. | .. | .. | 1 | 1 |
| Rotifera | .. | .. | .. | 100 | .. | 200 | .. | .. | 100 | .. | 1 | 200 | .. | .. |
| TOTAL | 0 | 4 | 4 | 106 | 9 | 201 | 1 | 0 | 101 | 0 | 9 | 216 | 1 | 1 |
| *Phytoplankton* | | | | | | | | | | | | | | |
| Chlorophyta | 100 | 100 | 100 | ... | 100 | 200 | ... | 100 | 300 | ... | 100 | 200 | 100 | 100 |
| Chrysophyta | 300 | 200 | 3200 | ... | 200 | 300 | 200 | 200 | 400 | 100 | 500 | ... | ... | 2800 |
| Cyanophyta | | ... | .... | ... | ... | ... | 500 | 100 | ... | ... | 100 | 300 | ... | .... |
| Euglenophyta | | ... | .... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | .... |
| TOTAL | 400 | 300 | 3300 | 0 | 300 | 500 | 700 | 400 | 700 | 100 | 700 | 500 | 100 | 2900 |

## Table XVII
## MONTHLY NET PLANKTON COUNTS PER LITER FROM SABINE IV

| | 1964 | | | | 1965 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Organism* | *Sept.* | *Oct.* | *Nov.* | *Dec.* | *Jan.* | *Feb.* | *Mar.* | *Apr.* | *May* | *June* | *July* | *Aug.* | *Sept.* | *Oct.* | *Nov.* | *Dec.* |
| *Zooplankton* | | | | | | | | | | | | | | | | |
| Cladocera | .. | .. | .. | .. | .. | .. | ... | .. | .. | .. | .. | .. | .. | .. | .. | 1 |
| Copepoda | .. | .. | .. | .. | .. | .. | ... | 2 | .. | 1 | .. | .. | .. | .. | .. | .. |
| Nauplius | .. | .. | .. | .. | .. | 2 | .. | 2 | .. | 1 | .. | .. | .. | .. | .. | .. |
| Rotifera | .. | .. | .. | .. | .. | .. | 100 | 100 | .. | .. | .. | .. | .. | .. | .. | .. |
| TOTAL | 0 | 0 | 0 | 0 | 0 | 2 | 100 | 104 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Phytoplankton* | | | | | | | | | | | | | | | | |
| Chlorophyta | ... | 100 | ... | ... | ... | ... | ... | 2800 | 300 | ... | 100 | ... | ... | ... | ... | ... |
| Chrysophyta | ... | ... | ... | ... | ... | 200 | ... | .... | ... | 500 | 100 | ... | ... | 900 | 100 | 300 |
| Cyanophyta | ... | 300 | 200 | ... | ... | ... | ... | .... | 400 | 100 | ... | ... | ... | ... | ... | ... |
| Euglenophyta | 100 | ... | ... | ... | ... | ... | ... | .... | ... | ... | ... | ... | ... | ... | ... | ... |
| TOTAL | 100 | 400 | 200 | 0 | 0 | 200 | 0 | 2800 | 700 | 600 | 200 | 0 | 0 | 900 | 100 | 300 |

| Organism | 1966 Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | 1967 Jan. | Mar. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Zooplankton* | | | | | | | | | | | | | | |
| Cladocera | .. | .. | .. | 1 | .. | 2 | .. | .. | .. | .. | .. | 5 | .. | .. |
| Copepoda | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Nauplius | .. | .. | .. | 1 | 5 | .. | .. | .. | .. | .. | .. | .. | 5 | .. |
| Rotifera | | .. | .. | 300 | .. | .. | .. | .. | .. | .. | .. | .. | 100 | .. |
| TOTAL | 0 | 0 | 1 | 302 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 5 | 105 | 0 |
| *Phytoplankton* | | | | | | | | | | | | | | |
| Chlorophyta | 200 | ... | 100 | ... | ... | 200 | 100 | 100 | ... | ... | ... | ... | 100 | 200 |
| Chrysophyta | 100 | ... | 1100 | ... | ... | ... | 100 | ... | 100 | 200 | 200 | 100 | ... | 1500 |
| Cyanophyta | ... | ... | .... | ... | ... | ... | 300 | ... | ... | 100 | ... | 100 | ... | ... |
| Euglenophyta | ... | ... | .... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | .... |
| TOTAL | 300 | 0 | 1200 | 300 | 0 | 202 | 500 | 100 | 100 | 300 | 200 | 200 | 100 | 1700 |

of phytoplankton. Certain physio-chemical conditions were closely correlated with the phytoplankton bloom, but this monthly data does not reveal any limiting chemical values during the study. Increased phytoplankton in Lac Des Allemands correlated closely with temperature and turbidity increases each spring as well as development of brackish conditions in the area. High carbonate alkalinity and pH values prevailed during this brackish period, along with increased total chloride values over late fall and winter conditions.

### *Net and Nanno Plankton Production in Sabine River*

Monthly net and nanno plankton weights and counts of the Sabine River are presented in Figure 24 through Figure 27 and Table XIV through Table XVII. Minimum net plankton counts and weights occurred during the late fall and winter of each year. Net plankton productivity usually began to increase by February of each year, but counts and weights reveal sporadic pulses throughout the warm months without a predictable trend toward summer maximum productivity. Nanno plankton weights (Figures 24 through 27) also exhibited parallel higher values one month then low values the following month. The mean study gravimetric results of net plankton were 0.223 gms/m$^3$ for Station I, 0.183 gms/m$^3$ for Station II, 0.151 gm/m$^3$ for Station III and 0.124 gms/m$^3$ for Station IV. The mean study gravimetric results of nanno plankton were 4.326 gm /m$^3$ for Station I, 4.353 gms/m$^3$ for Station II, 3.752 gms/m$^3$ for Station III and 3.496 gms/m$^3$ for Station IV.

The major zooplankton group occurring in monthly net plankton counts was Rotifera. The genus *Keratella* was the dominant plankton during peak occurrence of zooplankton. The major phytoplankton groups represented in monthly net plankton counts were Chrysophyta, Chlorophyta and Cyanophyta. Chrysophyta, the dominant group of the three phyla, was always represented by high counts of *Pennales* sp. and lesser numbers of *Synura* sp. during phytoplankton pulses. Chlorophyta usually occurred three to four months during the year and was represented by species of *Spirulina* and *Chroococcus.*

Plankton pigments presented in Tables XVIII through XXI also indicate pulses of plankton productivity in the Sabine

PHYTOPLANKTON PIGMENTS FROM STATION 1 OF SABINE RIVER

| Month | Chlorophyll a | Chlorophyll b | Chlorophyll c | Carotenoid ac | Carotenoid nac |
|---|---|---|---|---|---|
| August, 1964 | ... | ... | ... | ... | ... |
| September | 5.06 | 2.30 | 7.16 | 1.14 | 1.90 |
| October | 2.69 | 1.22 | 1.83 | 0.20 | 0.29 |
| November | 0.16 | 0.72 | 0.72 | 0.20 | 0.28 |
| December | 1.07 | 0.64 | 0.95 | 0.13 | 0.03 |
| January, 1965 | 2.55 | 1.00 | 1.87 | 0.34 | 0.18 |
| February | 0.18 | 0.82 | 3.00 | 0.49 | 0.04 |
| March | 1.18 | 0.88 | 2.72 | 0.35 | 0.01 |
| April | 4.08 | 1.22 | 3.68 | 0.44 | 0.50 |
| May | 1.39 | 0.92 | 1.21 | 0.25 | 0.02 |
| June | 0.68 | 0.57 | 1.78 | 0.05 | 0.13 |
| July | 0.77 | 0.71 | 1.60 | 0.22 | 0.15 |
| August | 1.59 | 1.62 | 2.22 | 0.42 | 0.11 |
| September | 2.60 | 1.59 | 3.48 | 0.47 | 0.03 |
| October | ... | ... | ... | ... | ... |
| November | 1.13 | 1.15 | ... | 0.31 | 0.13 |
| December | 1.58 | 0.98 | 2.53 | 0.44 | 0.08 |
| January, 1966 | 0.97 | 0.65 | 0.77 | 0.15 | 0.10 |
| February | 1.10 | 0.83 | 0.87 | 0.28 | 0.13 |
| March | 4.64 | 4.33 | 3.64 | 0.33 | 0.46 |
| April | 0.96 | 1.00 | 0.80 | 0.08 | 0.31 |
| May | ... | ... | ... | ... | ... |
| June | 4.24 | 3.20 | 2.51 | 0.39 | 0.59 |
| July | 3.02 | 2.60 | 1.00 | 0.12 | 0.60 |
| August | 4.83 | 3.80 | 2.25 | 0.57 | 0.02 |
| September | 2.47 | 2.42 | 1.10 | 0.23 | 0.21 |
| October | 7.12 | 5.87 | 3.79 | 0.57 | 0.69 |
| November | ... | ... | ... | ... | ... |
| December | 1.49 | 1.55 | 1.94 | 0.13 | 0.05 |
| January, 1967 | 4.83 | 4.77 | 4.89 | 0.38 | 0.16 |
| Mean | 2.40 | 1.82 | 2.33 | 0.33 | 0.28 |

*Milligram per liter (mg/1)—chlorophyll a and chlorophyll b values

Milligram specific pigment units (MSPU)—chlorophyll c, carotenoid ac and carotenoid nac values.

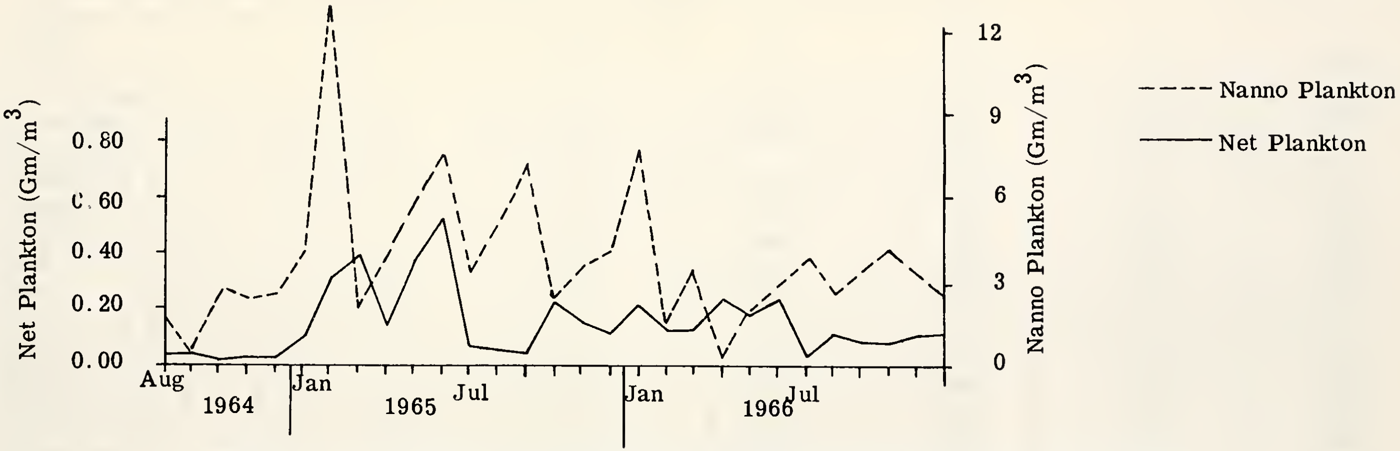

Figure 26—Monthly Variations of Weight (Gm/m3) of Net and Nanno Plankton at Station III of Sabine River

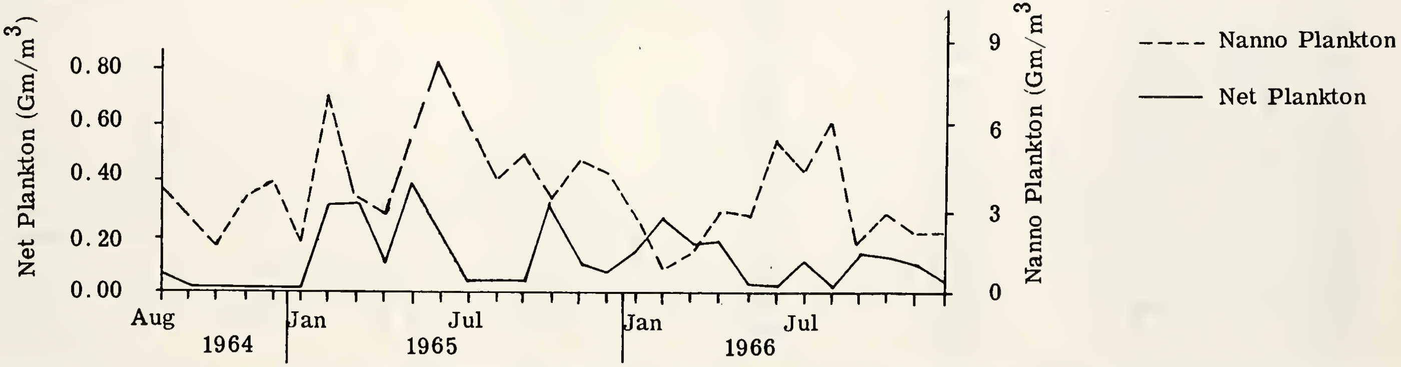

Figure 27—Monthly Variations of Weight (Gm/m3) of Net and Nanno Plankton at Station IV of Sabine River

OF SABINE RIVER*

| Month | Chlorophyll a | Chlorophyll b | Chlorophyll c | Carotenoid ac | Carotenoid nac |
|---|---|---|---|---|---|
| August, 1964 | ... | ... | ... | ... | ... |
| September | 8.33 | 2.56 | 5.86 | 0.67 | 0.95 |
| October | 3.33 | 1.09 | 0.59 | 0.23 | 0.65 |
| November | 5.24 | 1.81 | 2.48 | 0.52 | 0.24 |
| December | 1.39 | 0.49 | 2.87 | 0.35 | 0.11 |
| January, 1965 | 2.54 | 1.21 | 3.83 | 0.68 | 0.06 |
| February | 2.44 | 1.34 | 6.46 | 1.07 | 0.30 |
| March | 1.61 | 1.21 | 3.83 | 0.60 | 0.20 |
| April | 4.29 | 1.49 | 4.35 | 0.76 | 0.36 |
| May | 1.40 | 0.92 | 1.58 | 0.33 | 0.03 |
| June | 3.05 | 2.87 | 6.47 | 0.12 | 0.21 |
| July | 2.29 | 2.19 | 2.35 | 0.33 | 0.02 |
| August | 2.22 | 1.94 | 0.62 | 0.37 | 0.04 |
| September | 2.02 | 1.21 | 2.80 | 0.33 | 0.04 |
| October | ... | ... | ... | ... | ... |
| November | 1.68 | 1.64 | 2.20 | 0.35 | 0.01 |
| December | 1.05 | 1.14 | 1.25 | 0.80 | 0.08 |
| January, 1966 | 1.01 | 0.86 | 0.65 | 0.08 | 0.01 |
| February | 1.29 | 0.73 | 1.64 | 0.21 | 0.07 |
| March | 3.11 | 2.82 | 2.26 | 0.29 | 0.24 |
| April | 0.17 | 0.20 | 0.00 | 0.00 | 0.00 |
| May | ... | ... | ... | ... | ... |
| June | 3.00 | 3.29 | 2.58 | 0.26 | 0.72 |
| July | 2.16 | 1.90 | 1.33 | 0.26 | 0.83 |
| August | 5.04 | 2.85 | 0.39 | 0.27 | 0.43 |
| September | 8.68 | 8.10 | 6.64 | 0.53 | 0.87 |
| October | 7.17 | 5.90 | 3.31 | 0.66 | 0.82 |
| November | ... | ... | ... | ... | ... |
| December | 5.70 | 5.27 | 5.28 | 0.32 | 0.37 |
| January, 1967 | 6.26 | 5.54 | 4.98 | 0.44 | 0.41 |
| Mean | 3.21 | 2.33 | 2.94 | 0.42 | 0.31 |

*Milligram per liter (mg/1)—chlorophyll a and chlorophyll b values
Milligram specific pigment units (MSPU)—chlorophyll c, carotenoid ac and carotenoid nac values

### TABLE XX
### PHYTOPLANKTON PIGMENTS FROM STATION III OF SABINE RIVER*

| *Month* | *Chlorophyll a* | *Chlorophyll b* | *Chlorophyll c* | *Carotenoid ac* | *Carotenoid nac* |
|---|---|---|---|---|---|
| August, 1964 | 3.94 | 1.16 | 3.62 | 0.32 | 0.64 |
| September | ... | ... | ... | ... | ... |
| October | 2.59 | 0.68 | 2.31 | 0.20 | 0.46 |
| November | 1.11 | 0.65 | 0.72 | 3.20 | 0.38 |
| December | 2.15 | 1.09 | 2.60 | 0.51 | 0.05 |
| January, 1965 | 7.90 | 2.74 | 3.85 | 0.31 | 0.97 |
| February | 1.38 | 0.70 | 2.16 | 0.60 | 0.07 |
| March | 3.83 | 1.13 | 4.36 | 0.63 | 0.45 |
| April | 2.11 | 0.88 | 2.71 | 0.42 | 0.05 |
| May | 1.81 | 1.09 | 1.66 | 0.40 | 0.75 |
| June | 0.83 | 0.61 | 2.12 | 0.08 | 0.04 |
| July | 0.63 | 0.99 | 0.56 | 0.22 | 0.11 |
| August | ... | ... | ... | ... | ... |
| September | 3.05 | 1.93 | 2.36 | 0.19 | 0.46 |
| October | ... | ... | ... | ... | ... |
| November | 1.11 | 1.00 | 1.80 | 0.41 | 0.06 |
| December | 1.02 | 0.76 | 0.10 | 0.31 | 0.04 |
| January, 1966 | 0.69 | 0.96 | 1.77 | 0.09 | 0.03 |
| February | 0.47 | 0.41 | 1.09 | 0.28 | 0.13 |
| March | 2.28 | 1.91 | 1.17 | 0.34 | 0.06 |
| April | 0.28 | 0.27 | 0.00 | 0.00 | 0.00 |
| May | ... | ... | ... | ... | ... |
| June | 6.73 | 6.59 | 5.08 | 0.42 | 1.14 |
| July | 1.73 | 1.70 | 0.91 | 0.15 | 0.26 |
| August | 2.15 | 2.01 | 1.10 | 0.17 | 0.37 |
| September | 2.51 | 2.01 | 0.40 | 0.23 | 0.34 |
| October | 2.58 | 2.04 | 0.58 | 0.25 | 0.22 |
| November | 2.33 | 2.01 | 1.75 | 0.23 | 0.30 |
| December | 0.70 | 0.54 | 0.83 | 0.06 | 0.08 |
| January, 1967 | 1.22 | 1.12 | 1.05 | 0.17 | 0.04 |
| Mean | 2.20 | 1.38 | 1.79 | 0.39 | 0.29 |

*Milligram per liter (mg/1)—chlorophyll a and chlorophyll b values

## PHYTOPLANKTON PIGMENTS FROM STATION IV OF SABINE RIVER*

| Month | Chlorophyll a | Chlorophyll b | Chlorophyll c | Carotenoid ac | Carotenoid nac |
|---|---|---|---|---|---|
| August, 1964 | 3.94 | 1.16 | 3.62 | 0.32 | 0.64 |
| September | ... | ... | ... | ... | ... |
| October | 1.86 | 0.54 | 0.84 | 0.20 | 0.44 |
| November | 0.92 | 0.55 | 1.58 | 3.01 | 0.35 |
| December | 2.15 | 0.83 | 4.15 | 0.48 | 0.03 |
| January, 1965 | 2.44 | 0.92 | 1.82 | 0.44 | 0.12 |
| February | 1.53 | 0.83 | 2.01 | 0.39 | 0.02 |
| March | 4.80 | 3.35 | 16.50 | 2.68 | 1.49 |
| April | 3.16 | 1.00 | 4.62 | 0.72 | 0.01 |
| May | 2.45 | 1.81 | 3.87 | 0.76 | 0.15 |
| June | 0.68 | 0.57 | 1.78 | 0.05 | 0.13 |
| July | 0.77 | 0.71 | 1.60 | 0.22 | 0.14 |
| August | 1.59 | 1.62 | 2.22 | 0.42 | 0.11 |
| September | 2.60 | 1.59 | 3.48 | 0.47 | 0.03 |
| October | ... | ... | ... | ... | ... |
| November | 0.95 | 1.08 | 1.61 | 0.29 | 0.19 |
| December | 1.08 | 1.22 | 1.29 | 0.30 | 0.06 |
| January, 1966 | 0.85 | 0.53 | 0.29 | 0.19 | 0.05 |
| February | 0.65 | 0.70 | 1.17 | 0.09 | 0.07 |
| March | 2.03 | 1.97 | 1.48 | 0.21 | 0.22 |
| April | 0.23 | 0.23 | 0.00 | 0.00 | 0.00 |
| May | ... | ... | ... | ... | ... |
| June | 5.21 | 4.66 | 3.06 | 0.37 | 0.72 |
| July | 2.22 | 2.20 | 1.18 | 0.16 | 0.37 |
| August | 3.20 | 2.93 | 2.12 | 0.35 | 0.40 |
| September | 2.70 | 2.31 | 0.49 | 0.24 | 0.28 |
| October | 2.70 | 2.31 | 0.49 | 0.24 | 0.28 |
| November | 1.25 | 1.07 | 2.13 | 0.20 | 0.05 |
| December | 0.96 | 0.83 | 0.57 | 0.11 | 0.02 |
| January, 1967 | 1.22 | 1.12 | 1.05 | 0.17 | 0.04 |
| Mean | 2.01 | 1.43 | 2.41 | 0.48 | 0.24 |

*Milligram per liter (mg/ l)—chlorophyll a and chlorophyll b values
Milligram specific pigment units (MSPU)—chlorophyll c, carotenoid ac and carotenoid nac values.

## Table XXII
## MONTHLY COUNTS, WEIGHTS AND VOLUMES OF BOTTOM FAUNA FROM LAC DES ALLEMANDS

| | *Tubificidae* | *Chironomidae* | *Total (no/ft²)* | *Weight (gm/ft²)* | *Volume (cc/ft²)* |
|---|---|---|---|---|---|
| *1964* | | | | | |
| Nov. | 3 | 1 | 4 | 0.029 | 0.32 |
| Dec. | 3 | 3 | 6 | 0.018 | 0.08 |
| *1965* | | | | | |
| Jan. | 9 | 3 | 12 | 0.030 | 0.14 |
| Feb. | 8 | 3 | 11 | 0.062 | 0.13 |
| Mar. | 1 | 1 | 2 | 0.022 | 0.37 |
| Apr. | 2 | .. | 2 | 0.003 | 0.15 |
| May | 6 | 1 | 7 | 0.033 | 0.22 |
| June | 5 | 83 | 88 | 1.117 | 1.32 |
| July | 3 | 10 | 13 | 0.158 | 0.23 |
| Aug. | 3 | 10 | 13 | 0.193 | 0.29 |
| Sept. | 1 | 3 | 4 | 0.084 | 0.16 |
| Oct. | 8 | 9 | 17 | 0.240 | 0.46 |
| Nov. | 4 | 19 | 23 | 0.604 | 0.72 |
| Dec. | 2 | 4 | 6 | 0.018 | 0.11 |
| *1966* | | | | | |
| Jan. | 1 | 1 | 2 | 0.005 | 0.03 |
| Feb. | 2 | 9 | 11 | 0.286 | 0.38 |
| Mar. | 5 | 13 | 18 | 0.350 | 0.39 |
| Apr. | 2 | 2 | 4 | 0.026 | 0.06 |
| May | 1 | 1 | 2 | 0.010 | 0.09 |
| June | 1 | 1 | 2 | 0.015 | 0.04 |
| July | 2 | 1 | 3 | 0.013 | 0.05 |
| Aug. | 2 | 14 | 16 | 0.105 | 0.24 |
| Sept. | 2 | 1 | 3 | 0.013 | 0.04 |
| Oct. | * | * | * | * | * |
| Nov. | 2 | 1 | 3 | 0.009 | 0.04 |
| Dec. | 1 | 2 | 3 | 0.007 | 0.06 |
| Mean | | | | 0.138 | 0.024 |

*Not sampled

River from month to month. The lack of an extended period of plankton productivity during the spring and summer of each year was probably associated with stream discharges of turbid waters. Turbidity values in Figure 9 show the influence of muddy waters associated with spring rains and subsequent peak stream discharges. Stream discharge records in Table XI indicate peak discharges occurred between February and June of each year. Water temperatures (Figure 9) and alkalinity values (Figures 10 and 11) showed progressive spring increases to maximum midsummer values, a condition that is usually favorable to increased plankton productivity.

### *Bottom Fauna in Lac Des Allemands*

Monthly counts (no/ft$^2$), weights (gm/ft$^2$) and volumes (cc/ft$^2$) of bottom organisms present during the study in Lac Des Allemands are presented in Table XXII and Figure 23. Identification of organisms was usually to family. The two major invertebrate families present in the lake were Tubificidae and Chironomidae; Chironomidae being the most abundant during peak occurrence of bottom fauna. There was a seasonal peak occurrence of larvae Chironomidae each summer, followed by an emergence period in late summer. This emergence period was usually followed by an early fall buildup of immature Chironomidae. The mean study invertebrate weight and volume values for Lac Des Allemands during the two and one-half years of study were 0.138 gm/ft$^2$ and 0.024 cc/ft$^2$, respectively.

Channel catfish were obtained by trawling in June and November of 1966 and their stomach contents were examined to determine utilization of bottom fauna (Table XXIII). During both months channel catfish utilized Chironomidae, as well as Ostracoda and Corixidae which are not usually collected in Peterson dredge samples. Ceratopogonidae did not occur in dredge samples, although it was a major food item of catfish samples in June of 1966.

### *Bottom Fauna in Sabine River*

Quarterly samples of bottom fauna at the four stations of the Sabine River are presented in Tables XXIV through XXVII. The two upper stations exhibited higher numbers, volumes and weights of organisms per square foot than the two

## Table XXIII
## FOOD ITEMS FOUND IN STOMACHS OF CHANNEL CATFISH FROM LAC DES ALLEMANDS TRAWL SAMPLES

| *Organism* | June, 1966* *Frequency* | June, 1966* *Total No. Organisms* | June, 1966* *% of Total* | November, 1966** *Frequency* | November, 1966** *Total No. Organisms* | November, 1966** *% of Total* |
|---|---|---|---|---|---|---|
| Ostracoda | .. | .. | .. | 2 | 668 | 64.35 |
| Gammaridae | 6 | 11 | 6.51 | .. | ... | .... |
| Chironomidae | 4 | 42 | 24.85 | 8 | 370 | 35.65 |
| Ceratopogonidae | 5 | 74 | 43.79 | .. | ... | .... |
| Corixidae | 4 | 41 | 24.26 | .. | ... | .... |
| Sphaeriidae | 1 | 1 | 0.59 | .. | ... | .... |
| TOTAL | 20 | 169 | 100.00 | 10 | 1038 | 100.00 |

* 25 channel catfish ranging from 9.0 - 13.0 inches collected in June, 1966

** 20 channel catfish ranging from 4.5 - 10.5 inches collected in November, 1966

### TABLE XXIV
### SEASONAL COUNTS, WEIGHTS, AND VOLUMES OF BOTTOM FAUNA FROM SABINE RIVER I

| | Station I | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Organism* | *Fall 1964* | *Winter 1964-65* | *Spring 1965* | *Summer 1965* | *Fall 1965* | *Winter 1965-66* | *Spring 1966* | *Summer 1966* | *Fall 1966* | *Winter 1966-67* |
| Tubificidae | 10 | .. | 120 | .. | .. | 9 | 2 | 7 | .. | .. |
| Odonata | .. | .. | 3 | .. | .. | .. | 1 | .. | .. | .. |
| Ephemeroptera | 124 | .. | .. | 6 | .. | 3 | 15 | 1 | .. | 1 |
| Trichoptera | 23 | .. | .. | 2 | .. | .. | 3 | .. | .. | 2 |
| Coleoptera | 1 | 3 | .. | .. | ... | .. | .. | .. | .. | .. |
| Chironomidae | 12 | .. | 4 | 11 | .. | 14 | 45 | .. | 2 | 4 |
| Viviparidae | 1 | .. | 37 | 1 | 6 | 3 | .. | 1 | 2 | 3 |
| Unionidae | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Gammaridae | .. | .. | 15 | 1 | .. | .. | 80 | .. | .. | 1 |
| TOTAL (no/ft$^2$) | 172 | 3 | 179 | 21 | 6 | 29 | 106 | 9 | 4 | 11 |
| Weight (gm/ft$^2$) | 0.975 | 0.013 | 14.117 | 0.653 | 5.200 | 2.124 | 0.357 | 0.964 | 1.328 | 0.112 |
| Volume (cc/ft$^2$) | 1.50 | 0.11 | 13.10 | 0.20 | 5.40 | 2.00 | 0.35 | 0.85 | 3.10 | 0.05 |

## Table XXV
## SEASONAL COUNTS, WEIGHTS, AND VOLUMES OF BOTTOM FAUNA FROM SABINE RIVER II

| | *Station II* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Organism* | *Fall 1964* | *Winter 1964-65* | *Spring 1965* | *Summer 1965* | *Fall 1965* | *Winter 1965-66* | *Spring 1966* | *Summer 1966* | *Fall 1966* | *Winter 1966-67* |
| Tubificidae | 7 | .. | 28 | 17 | .. | 1 | 2 | .. | .. | .. |
| Odonata | .. | .. | .. | 1 | .. | 1 | 2 | .. | 2 | .. |
| Ephemeroptera | 5 | 3 | .. | 2 | .. | 7 | .. | 14 | .. | .. |
| Trichoptera | .. | .. | .. | .. | .. | .. | 1 | 1 | .. | .. |
| Coleoptera | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Chironomidae | 2 | 4 | 4 | .. | .. | 3 | 2 | 3 | .. | 4 |
| Viviparidae | 15 | 27 | 64 | 8 | 3 | 21 | 52 | .. | .. | .. |
| Unionidae | .. | 2 | 6 | 6 | .. | 9 | .. | .. | .. | .. |
| Gammaridae | .. | .. | .. | .. | .. | .. | .. | 15 | .. | .. |
| TOTAL (no/ft²) | 29 | 36 | 102 | 34 | 3 | 42 | 59 | 33 | 2 | 4 |
| Weight (gm/ft²) | 1.713 | 4.260 | 8.718 | 5.521 | 1.439 | 6.836 | 4.070 | 1.321 | 0.317 | 0.001 |
| Volume (cc/ft²) | 1.70 | 3.90 | 7.90 | 5.00 | 1.40 | 6.9 | 3.40 | 1.45 | 0.10 | 0.01 |

### TABLE XXVI
### SEASONAL COUNTS, WEIGHTS, AND VOLUMES OF BOTTOM FAUNA FROM SABINE RIVER III

| | Station III | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Organism* | *Fall 1964* | *Winter 1964-65* | *Spring 1965* | *Summer 1965* | *Fall 1965* | *Winter 1965-66* | *Spring 1966* | *Summer 1966* | *Fall 1966* | *Winter 1966-67* |
| Tubificidae | 1 | 1 | .. | 4 | .. | 1 | .. | .. | .. | .. |
| Odonata | .. | .. | .. | .. | 1 | .. | 2 | .. | .. | .. |
| Ephemeroptera | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. |
| Trichoptera | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Coleoptera | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Chironomidae | .. | 1 | .. | .. | 107 | .. | 2 | 2 | .. | .. |
| Viviparidae | .. | 2 | .. | .. | .. | .. | .. | .. | .. | .. |
| Unionidae | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Gammaridae | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| TOTAL | 1 | 4 | 0 | 4 | 108 | 1 | 5 | 2 | * | * |
| Weight (gm/ft²) | 0.003 | 0.016 | 0 | 0.001 | 0.021 | 0.001 | 0.053 | 0.005 | | |
| Volume (cc/ft²) | 0.06 | 0.03 | 0 | 0.01 | 0.10 | 0.01 | 0.02 | 0.05 | | |

*Not sampled

## Table XXVII
## SEASONAL COUNTS, WEIGHTS, AND VOLUMES OF BOTTOM FAUNA FROM SABINE RIVER IV

| | Station IV | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Organism* | *Fall 1964* | *Winter 1964-65* | *Spring 1965* | *Summer 1965* | *Fall 1965* | *Winter 1965-66* | *Spring 1966* | *Summer 1966* | *Fall 1966* | *Winter 1966-67* |
| Tubificidae | 63 | 2 | 14 | .. | 6 | 1 | .. | 4 | .. | .. |
| Odonata | 2 | .. | .. | .. | .. | 1 | 2 | .. | .. | .. |
| Ephemeroptera | 20 | .. | .. | 3 | .. | 4 | .. | .. | .. | .. |
| Trichoptera | .. | .. | .. | .. | .. | 3 | .. | 2 | .. | .. |
| Coleoptera | .. | .. | .. | .. | .. | 3 | .. | .. | .. | .. |
| Chironomidae | 1 | .. | 1 | .. | 38 | 1 | .. | 18 | .. | .. |
| Viviparidae | 1 | .. | 1 | .. | 1 | .. | 1 | .. | .. | .. |
| Unionidae | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Gammaridae | 3 | .. | 2 | .. | .. | 44 | .. | 2 | .. | .. |
| TOTAL (no/ft²) | 90 | 2 | 21 | 3 | 45 | 57 | .. | 26 | * | * |
| Weight (gm/ft²) | 0.691 | 0.002 | 3.742 | 0.008 | 0.015 | 0.071 | 0.248 | 0.019 | | |
| Volume (cc/ft²) | 0.02 | 0.21 | 2.10 | 0.10 | 0.20 | 0.20 | 0.40 | 0.20 | | |

*Not sampled

lower stations. There was also a difference in the dominant benthic groups found in the upper stations as compared to the lower stations. Tubificidae, Ephemeroptera, Tricoptera, Chironomidae and Viviparidae were the major representatives in quarterly samples at Station I. This station exhibited a typical population indicative of its shallow, swift water conditions. Tubificidae, Ephemeroptera, Chironomidae and Viviparidae were the common groups at Station II. The large volumes and weights of Viviparidae at the two upper stations are due to the abundance of *Viviparus* sp. present in the seasonal samples. The major groups of bottom fauna at Stations III and IV were Tubificidae and Chironomidae.

There was an indication of maximum spring production of bottom fauna in the Sabine River. More frequent sampling of the benthos (monthly rather than quarterly) would have presented a better picture of this habitat of the stream. Short life cycles, predation and other natural forces often produce rapid changes in invertebrate bottom fauna. The design of this job was not to present a detailed survey of this habitat, but to establish the qualities and quantities of bottom fauna in the Sabine River.

## CONCLUSIONS

1. Collections of fish from the Sabine River represented seventeen families, thirty-five genera and sixty-five species. Members of the Centrarchidae and Cyprinidae families were the most common, with no major changes in fish populations from that reported by earlier investigators. Data collected during this fish survey was used in recommending stocking only one native fish species following October, 1966 closure of the Sabine River to create Toledo Bend Reservoir. Texas and Louisiana biologists stocked 3,000,000 largemouth bass fingerlings in the river in the spring of 1967. Louisiana biologists also stocked non-native striped bass and walleye fingerlings in the filling lake in the springs of 1967 and 1968. A post-impoundment study of the expansion of fish populations in the new impoundment should be started with emphasis placed on native and the two non-native fish species.

2. Standing crop values from Lac Des Allemands indicate this coastal lake supports a heavy commercial fish population and moderate sports fish population. Yellow bass and black crappie are the principal game fish that frequent the lake each summer. There are indications that there are seasonal movements of game and commercial fish species between the lake and adjacent waters. The lake supports a high poundage of channel catfish (three year mean of 87 pounds per acre), yet only 20 percent of this weight is of marketable size based on the present Louisiana limit of 13 inches total length. Consideration should be given to reducing the legal marketable size of channel catfish to 10 inches total length in Lac Des Allemands and similar coastal lakes of Louisiana. This will increase harvest of this commercial species and improve catfish populations that may be suffering from the stunting effects of overcrowding. Hoop net, gill webbing, slat traps and cans should not be restricted from commercial fishing use in these types of brackish lakes. A detailed study of age, growth, spawning success and movements of all species of catfish should be undertaken in the near future to better understand the status of this valuable fish in coastal Louisiana lakes.

3. Results of water quality studies of the Sabine River during this project are very similar to that reported by Hughes and Leifeste in 1965. Variations in the chemical quality of the surface waters of the Sabine River Basin are caused principally by area differences in geology and water runoff; but industrial influence, particularly the disposal of oil-field brines, affect the quality in limited areas. Water having the least dissolved solids is found in the lower part of the basin, where rainfall is greatest. Water having higher values of hardness is in areas of Cretaceous limestone, chalk and marl in the upper part of the drainage. Chloride concentrations are generally low except where streams are polluted by oil-field brines and localized natural saline inflow. The water in Toledo Bend Reservoir should be of good quality if brine releases are not allowed to increase or are reduced through the use of injection wells.

4. Lac Des Allemands is a freshwater lake during the winter of each year, but a brackish condition begins to develop in late spring and persists throughout the summer and into the fall of each year. The development of the brackish condition

coincided with a persistent blue-green algae bloom that prevailed from April through October of each year. The development of the brackish condition probably influences the movement of game and commercial fish species between the lake and adjacent waters.

5. Net plankton productivity in Lac Des Allemands increased gradually in early spring to maximum June counts and weights. Cladocera and Rotifera were the principal zooplankton groups and Cyanophyta and Chlorophyta were the principal phytoplankton groups of net plankton. Nanno plankton productivity in the lake closely followed net plankton weights, with maximum summer and early fall values and also January pulses each year. Throughout the spring, summer and fall of each year Lac Des Allemands exhibited a characteristic blue-green color indicative of its heavy bloom of *Microcystis* sp. Increased phytoplankton production in the lake each year correlated closely with temperature and turbidity increases each spring as well as development of brackish conditions in the area.

6. Net plankton production in the Sabine River usually began to increase by February of each year, but counts and weights revealed sporadic high to low values throughout the warm months without predictable trends toward summer maximum production. Nanno plankton production also exhibited parallel high values one month followed by low values the next month. The lack of an extended period of high plankton density during the spring and summer was probably associated with peak spring stream discharges of muddy waters. Rotifera, represented mainly by *Keratella* sp., was the major zooplankton group in monthly net plankton counts. Chrysophyta, represented by high counts of *Pennales* sp., was the dominant net phytoplankton group in the Sabine River.

7. The two upper stations of the Sabine River exhibited higher seasonal numbers, volumes and weights of bottom organisms than found at the two lower stations. There was an indication of maximum spring production of bottom fauna in the Sabine River.

8. The two major benthic groups in Lac Des Allemands were Tubificidae and Chironomidae, with Chironomidae spe-

cies being most abundant during peak occurrences of bottom fauna. There was a seasonal peak occurrence of larval Chironomidae each summer, followed by an early fall buildup of the same group. Stomach samples of channel catfish in the summer and early winter of 1966 indicated a good utilization of Chironomidae by this abundant fish species.

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# CONSERVATION PLEDGE

*I give my*
*pledge as an American*
*to save and faithfully to*
*defend from waste the*
*natural resources of*
*my country—its soil*
*and minerals, its*
*forests, waters,*
*and wildlife*

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